SBD DAUNTLESS VS A6M ZERO-SEN

Pacific Theater 1941–44

DONALD NIJBOER

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INTRODUCTION

> "The SBD was a workhorse. It could come home with huge holes in the wings and pieces shot off all over – a gorgeous airplane, and I was very lucky to fly it."
> Maj Leo R. Smith, CO of VMSB-231, Guadalcanal, 1942

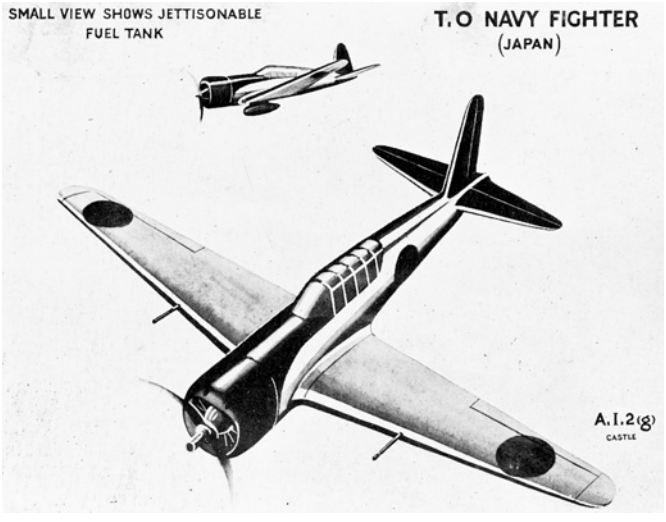
The Douglas SBD Dauntless dive-bomber's place in military aviation history is often over-shadowed by the more well-known and iconic aircraft of World War II. In Britain, the Spitfire, Hurricane, and Lancaster are revered. For Americans, the Boeing B-17 Flying Fortress and P-51 Mustang are seen as the key war-winning machines of the conflict. Japan's Mitsubishi A6M Zero-sen is also amongst the most familiar types of the Pacific War. Yet despite its unrivaled performance in 1941–42, the Zero-sen was unable to stop the most capable and destructive dive-bomber of World War II. The SBD Dauntless proved to be the perfect weapon during one of the pivotal moments in modern military history, and it did more to bring about a US victory in the Pacific than any other aircraft.

The duel between the Zero-sen and the SBD Dauntless was a unique example of the bomber versus fighter dynamic. Virtually every bomber in World War II was vulnerable to fighter attack no matter how many guns and turrets were employed – they could not survive without fighter escort. That was not quite the case for the Dauntless, however. Even without an escort, an SBD pilot and his radioman-gunner had a good chance of survival, although many returned with heavily damaged aircraft. The Zero-sen was clearly superior to the Dauntless in every respect, but for US Navy and US Marine Corps aircrews, their trusty SBDs came with some unique fighting features.

The encounters between Zero-sens and Dauntlesses during four carrier battles in 1942 and the struggle for Guadalcanal (August 1942 to February 1943) demonstrated the American dive-bomber's ability not only to survive, but, once free of its bombload,

use its maneuverability to make it very difficult to shoot down. Furthermore, considering its primary role, the SBD was relatively well-armed for air-to-air combat, mounting two forward-firing M2 Browning 0.50-cals over the engine cowling and twin Browning AN/M2 0.30-cals for the radioman-gunner.

The surprise attack by the Imperial Japanese Navy (IJN) on Pearl Harbor on December 7, 1941 introduced the wider world to the Mitsubishi A6M2 Zero-sen. Although the fighter had seen combat in China since September of the previous year, the appearance of the Zero-sen and its dominance over Allied fighters like the Curtiss P-36 and P-40, Hawker Hurricane, and Brewster Buffalo in the first year of the Pacific War came as a baffling shock to the western Allies. Indeed, their intelligence on the Japanese aviation industry, and its technological capabilities, had been very poor in the lead up to war, having been shaped in great part by colonial attitudes and racial stereotypes. Few believed the Japanese were capable of designing and constructing combat aircraft equal to or better than Allied designs.



The lack of Allied information on the A6M Zero-sen pre-war is clearly evident in this early British Air Intelligence 2(g) drawing, purportedly of the Japanese fighter. It bears a strong resemblance to the Vultee P-66 Vanguard, 129 of which were supplied to the Chinese in 1940. (NHHC)

At the same time, British and American air attachés in China and former US Army Air Corps (USAAC) pilot Maj Claire Lee Chennault, aviation advisor to the Republic of China Air Force (RoCAF), were passing along fairly accurate details about the Zero-sen, only for them to fall on deaf ears. The disregard for Japan's air power was exemplified by a report prepared by the US naval attaché in Tokyo, Lt Cdr Stephen Juricka, before the outbreak of war. After seeing a Zero-sen close up during an airshow, he sent home a detailed report. Although it was generally ignored, Juricka's report was taken very seriously by the US Navy, prompting its Bureau of Aeronautics (the material-support organization for naval aviation from 1921 to 1959) to issue a Fleet Air Tactical Bulletin in September 1941 detailing its performance and capabilities. While this provided US Naval Aviators with some knowledge of what to expect, the fighter's performance in combat still came as a nasty, and often deadly, shock.

While reports on the Zero-sen's performance were being largely ignored by the Allies, the Dauntless entered squadron service in June 1940. The US Marine Corps' VMB-1 at Quantico, Virginia, received the first production SBD-1s, although this variant was not deemed combat-capable. With a top speed of 253mph and a range of 860 miles, 57 SBD-1s were built. Often described as "obsolete" at the start of the Pacific War, the follow-on SBD-2/3s that equipped frontline units were, in fact, more effective dive-bombers than their Imperial Japanese Naval Air Force (IJNAF) equivalent, the Aichi D3A1 (given the Allied reporting name "Val" in mid 1942).

Like the majority of IJNAF combat aircraft, the "Val" was of light construction, poorly armed, and carried no armor plating or self-sealing fuel tanks. In comparison, the SBD-3, which entered service in March 1941, was equipped with an armored windscreen, armor plating for both the pilot and radioman-gunner, and self-sealing fuel tanks. It was also capable of carrying a 1,000lb bomb, compared to the "Val's"

A6M2 V-172 of the Tainan Kokutai, flown by PO1c Shimezoh Inoue, became the first virtually intact Zero-sen to fall into Allied hands when, on November 26, 1941, it was one of two IJNAF fighters to land on a deserted beach on China's Leichou coast. Inoue and FPO2c Taka-aki Shimohigashi had become lost in fog during a flight from Tainan, in Taiwan (then Formosa), to Saigon, in Vietnam (then French Indochina). V-174 was badly damaged in the beach landing, and it was chopped up into transportable pieces, but V-172 was recovered almost intact. (NARA)

800lb load. The SBD's offensive and defensive capabilities came as a surprise to the Japanese, and they were never fully able to counter them.

The crews flying the SBD during 1941–42 employed pre-war tactics they hoped would serve them well, and allow them to exploit the few advantages (rugged construction, armor plating, and good armament) they had over the appreciably quicker and better armed Zero-sen. Like all bombers, the SBD was vulnerable to determined fighter attack. Armed with two Type 99-1 20mm cannon and two Type 97 7.7mm machines guns, the Zero-sen had more than enough firepower to take on the slow-flying SBD.

To increase their chances of survival, the Dauntless crews devised tight formations that provided overlapping and mutually supporting fields of fire. The smallest formation was the three-ship section, with a leader and two wingmen in a vic. Usually the wingmen flew slightly behind on either side, stepped up or down according to the tactical situation. This gave the rear gunners good fields of fire if attacked from above and, to a certain extent, from the side and from below.

A three-ship SBD-3 formation had six 0.30-cal. machine guns for protection from the rear. The rate of fire for the twin mount was 2,400 rounds per minute. While the Browning AN/M2 was a small-caliber weapon, the combined firepower of a three-ship formation gave the SBD gunners a capable defense. For head-on attacks, pilots could rely on two hard-hitting 0.50-cal. machine guns. The US Navy also made it a priority to give radioman-gunners ample training, while pilots in scouting squadrons (VS) practiced for air-to-air combat – such training was not given to Naval Aviators flying SBDs with bombing squadrons (VB), however. SBD crews were also able to take advantage of the Zero-sen's greatest weakness; its lack of armor protection for the pilot and self-sealing fuel tanks.

On December 6, 1941, the IJNAF had more than 100 A6M2s embarked in six IJN fleet carriers of 1st Koku Kantai (First Air Fleet), with a further 120 A6M2s assigned to the land-based 11th Koku Kantai. The US Navy's Pacific Fleet carriers and land-based US Marine Corps units were equipped with 192 SBDs, with six squadrons assigned to the air groups embarked in USS *Lexington* (CV-2), USS *Saratoga* (CV-3), and USS *Enterprise* (CV-6).

The eighth and tenth SBD-1s completed by Douglas await collection by the US Marine Corps at the company's El Segundo plant in mid-1940. Both aircraft were assigned to pioneer Dauntless unit VMB-1, based at Quantico, in Virginia. Standard prewar markings seen here include chrome yellow wings and a vertically striped rudder. VMB-1 was later redesignated VMSB-132 in July 1941, and it deployed to Guadalcanal with 15 SBD-3s in November 1942. The aircraft in the foreground, BuNo 1603, was written off in a crash during dive-bombing training near San Diego, California, on July 13, 1942. (NHHC)

Newly repainted SBD-1s of VMSB-232 sit neatly lined up at Marine Corps Air Station Ewa, on Oahu, in the fall of 1941. As VMB-2, it had been the second frontline unit to receive Dauntlesses in December 1940. Nine of the squadron's aircraft were destroyed and ten badly damaged during the IJNAF attack on Pearl Harbor on December 7, 1941. (NHHC)

While the IJNAF raid on Pearl Harbor on December 7, 1941 has often been framed as a "sneak attack," it was not unexpected. The Americans knew that the Japanese were preparing to strike, but they did not know where in the Pacific the blow would fall. Now fully engaged, this was the war both sides had planned for and were ready to fight. In the four carrier battles that took place during the desperate months of 1942, the SBD was both numerically and operationally the most important American carrier aircraft. For the IJNAF, the A6M2 was its "ace in the hole." Fast, nimble and with a rate of climb unmatched by any other fighter, the Zero-sen's near invincibility in the early months of the Pacific War was one of the key factors in Japan's rapid advances through to mid-1942.

The SBD's astonishing success at the Battle of Midway is often viewed as the action that turned the tide in the Pacific War. However, the aerial engagements fought between Dauntlesses and A6M2/3s during the campaign for Guadalcanal would prove even more decisive. US Navy, US Marine Corps, and US Army Air Force (USAAF) units waged a war of attrition that the IJNAF could not possibly win. The six-month air, sea, and land battle that took place between August 1942 and February 1943 proved that air power in the Pacific would be the deciding factor.

The modest force of Dauntlesses committed to the campaign in the Solomons played a major part in securing victory. IJN transport vessels proved easy targets for the SBDs, forcing the Japanese to rely on less efficient destroyer runs to supply their garrison. While the IJNAF had numerical superiority, the A6M2 pilots had to fight from their base at Rabaul some 565 miles away. The long trip down and back was exhausting. It also meant an increasing percentage of Zero-sens could not be employed due to wear and tear, which in turn caused maintenance and serviceability issues. The long flight also made the IJNAF's tactics predictable and hindered its ability to keep fighter patrols over vulnerable convoys.

CHRONOLOGY

1922

March 20 US Navy's first carrier, USS *Langley* (CV-1), is commissioned

December 27 *Hosho*, the world's first purpose-designed aircraft carrier, is commissioned and enters service with the IJN.

1927

October First US Navy dive-bombing test against moving targets takes place, with good results.

1937

January IJNAF introduce the world's first monoplane shipboard fighter. The Mitsubishi A5M (subsequently codenamed "Claude") is superior to the Grumman F3F-1 biplane fighter that enters fleet service with the US Navy two months later.

1938

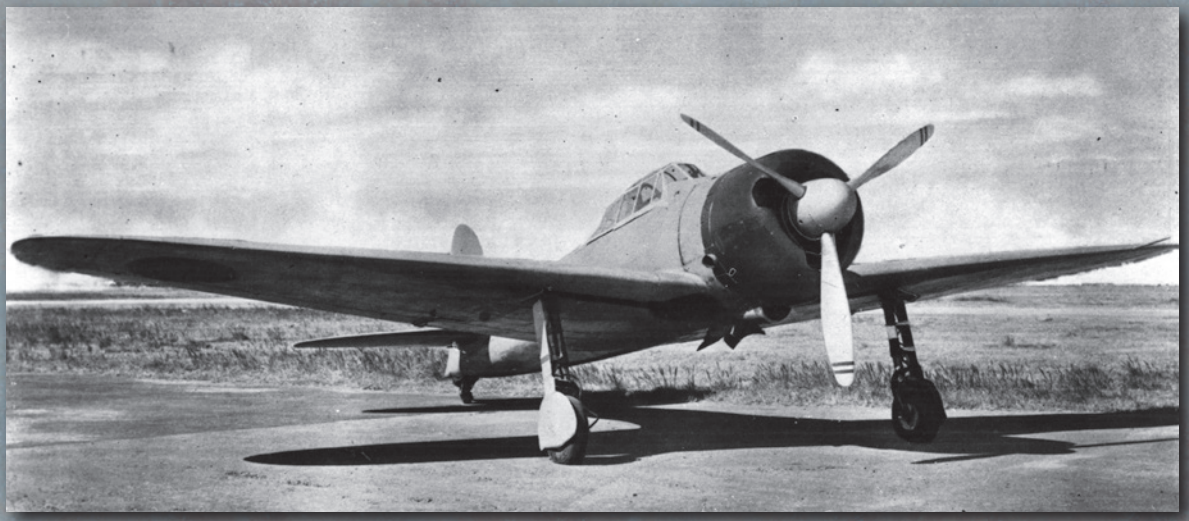
April The US Navy's first monoplane dive-bomber enters service, with a total of 54 Northrop BT-1s being assigned to three squadrons.

April 25 The Northrop XBT-2 makes its first flight.

October Northrop becomes a fully owned subsidiary of the Douglas Aircraft Company. After extensive wind tunnel testing and redesign, the XBT-2 is given the designation XSBD-1.

1939

April US Navy orders 57 SBD-1s and 87 SBD-2s. All of the former are subsequently supplied to the US Marine Corps, with the latter destined for US Navy carrier-based squadrons.



This aircraft was one of just 64 A6M2 Model 11s built by Mitsubishi in 1940, prior to production switching to the Model 21 with foldable wingtips. (Tony Holmes Collection)

April 1 Mitsubishi 12-shi Carrier Fighter prototype (subsequently redesignated A6M1 Zero-sen) performs its maiden flight.

1940

May 1 The first SBD-1 takes to the air at El Segundo, California.

July Carrier qualification trials for the A6M2 Model 21 are conducted aboard *Kaga*.

August 19 12 A6M2 Model 11 Zero-sens of 12th Kokutai undertake the type's first combat mission, escorting 54 G3M2 Type 96 bombers in China.

September US Navy orders 174 SBD-3s. This model is powered by a Wright R-1820-52 1,000hp engine.

1941

January USAAC orders 78 SBD-3s as its principal dive-bomber. Designated the A-24 Banshee, this version is identical to the SBD-3 minus the carrier landing equipment and arrestor hook. A total of 875 Banshees would eventually be built.

February 1 The Pacific Fleet is formally recreated after General Order 143 splits the US Fleet into separate Atlantic, Pacific, and Asiatic Fleets.

December Eight US Navy and two US Marine Corps squadrons are equipped with SBD-1/2/3s.

December 7 IJNAF aircraft flying from six carriers launch attacks on the US Navy's Pacific Fleet base at Pearl Harbor, Hawaii. A total of 108 Zero-sens provide fighter cover. During the First Wave strike, five SBDs from the carrier *Enterprise* are shot down by A6M2s from *Soryu*. One Zero-sen is in turn claimed destroyed by a Dauntless crew, and a second IJNAF fighter is possibly lost in an unwitnessed midair collision with an SBD.

1942

May 7–8 Battle of the Coral Sea. US Navy SBD-3s and TBD-1s sink the light carrier *Shoho*. IJNAF aircraft sink *Lexington*. SBD pilots and gunners claim 17 Japanese aircraft shot down, including nine Zero-sens. A6M2s in turn down at least six SBDs and inflict unrepairable damage on two more.

June 4–6 Battle of Midway. SBD-3s sink four fleet carriers and one heavy cruiser as the IJN suffers its first defeat. Again, A6M2s and Dauntlesses (both from Pacific Fleet carriers and Midway Atoll, the latter being US Marine Corps aircraft) clash during the course of the pivotal battle, with SBD crews claiming three Zero-sens destroyed. A total of 40 Dauntlesses are lost in combat, with a number of them falling to A6M2s.

August 7 American forces successfully land on Guadalcanal, in the Solomon Islands, encountering minimal Japanese resistance. Rabaul-based Zero-sen units immediately commence long-range escort missions for bombers targeting US Navy ships around Guadalcanal. High-scoring Zero-sen ace PO1c Saburo Sakai of Tainan Kokutai is gravely wounded by SBD rear gunners from VB-6, embarked in *Enterprise*.

August 12 The Japanese airfield that was under construction on Guadalcanal when the island was captured is completed and named Henderson Field in honor of SBD pilot Maj Lofton Henderson, who was killed leading the VMSB-231 attack during the Battle of Midway.

August 20 Twelve SBDs from US Marine Corps squadron VMSB-232 land at Henderson Field. Five more squadrons would fly in to Guadalcanal before year-end, and a

similar number of US Navy Dauntless units would also fly from Henderson between August and November while detached from their carriers.

August 24–25 Battle of the Eastern Solomons. SBDs from *Saratoga* hit the carrier *Ryujo* with three 1,000lb bombs.

October A6M3 Model 32 enters combat for the first time over the Solomon Islands. It has squared-off wingtips and is powered by a 1,130hp engine.

October Production of the SBD-4 with a 24-volt electrical system and a new propeller and fuel pumps begins – 780 are built.

October 26 The Battle of the Santa Cruz Islands provides the IJN with a major victory, as USS *Hornet* (CV-8) is sunk, leaving the US Navy with just one operational carrier in the South Pacific. SBD units claim 13 aerial victories that day, with eight of them being Zero-sens. Only two Dauntlesses were lost in return.

1943

February Production of the SBD-5, powered by the 1,200hp Wright R-1820-60 engine, commences at the new Tulsa, Oklahoma, plant, with 2,965 being built.

June US Navy has nine new fast carriers in service; four Essex-class fleet carriers and five Independence-class light carriers.

August Production of the A6M5 Model 52 begins. Top speed is 351mph at 19,500ft.

1944

February 17 US Navy Task Force (TF) 58 attacks the Japanese fortress at Truk, dubbed the "Gibraltar of the Pacific." No fewer than 138 SBD-5s are assigned to the strike, but they encounter no IJNAF fighters due to the effective escort provided by F6F Hellcats.

June 20 On the second day of the First Battle of the Philippine Sea, VB-10 from *Enterprise* and VB-16 from USS *Lexington* (CV-16) are intercepted by Zero-sens, and the latter unit claims two destroyed and 13 damaged for the loss of one SBD-5.

July 5 SBD-5s from VB-10 fly the last Dauntless mission from a carrier flightdeck.

August US Navy accepts its final 18 Dauntlesses. The SBD-6 is the last version produced, with 450 built.

1945

January Four SBD-equipped units assigned to Marine Air Group (MAG) 24 are committed to the campaign in the Philippines. These aircraft are infrequently engaged by Japanese fighters, including Zero-sens.

July Six US Marine Corps squadrons flying the SBD-6 remain in the Pacific. These aircraft support ground operations in the Philippines through to war's end.

SBD-5s from VB-16, embarked in *Lexington*, form up after each dropping a single 500lb GP bomb and two wing-mounted 250lb GP bombs on Param Island, near Truk Atoll, during TF 58's strike on the IJN fortress on April 29, 1944. More than 2,200 sorties were flown by SBDs, TBFs, and SB2Cs during the two-day operation, with the three types dropping 748 tons of bombs between them. (NARA)

DESIGN AND DEVELOPMENT

DOUGLAS SBD DAUNTLESS

On October 22, 1926, a flight of Curtiss F6C-1 Hawks from VF-2, led by squadron commander Lt Cdr Frank D. Wagner, simulated an attack on the heavy ships of the Battle Fleet just off San Pedro, California. In near-vertical dives from 12,000ft, they achieved complete surprise. Although the fleet had been warned, the Hawks remained undetected until after their runs. The combination of altitude and the speed attained in the diving attack caught the ships' crews flat-footed and unable to respond. The surprise was so complete that Adm Charles F. Hughes, Commander-in-Chief, Battle Fleet, concluded that his ships had no real defense against such tactics.

Some historians have claimed that this event was when the term "dive-bombing" was coined. While that may be true, the method of dropping bombs from a near vertical dive was first perfected by aviators of the US Marine Corps in 1919. However, no one knew what to call the tactic of releasing a bomb from a steeply diving aircraft. Various terms emerged, including light bombing and strafing with light bombs, until "dive-bombing" entered the lexicon of modern warfare.

In 1922, the US Navy's first carrier was commissioned. Converted from the former collier *Jupiter*, USS *Langley* was given the designation CV-1 (CV representing a fleet carrier and 1 being the first ship of this class). It was small, being just 542ft in length, and the vessel could carry up to 42 aircraft. After initial flight operations, it quickly became apparent that the number and type of aircraft available for sea duty was

limited. The mix of aircraft also had to be determined. The torpedo-bomber was the first natural choice, followed by the smaller fighter. The latter type was limited to fleet defense and could not carry a heavy bomb load. While the torpedo was potentially a "ship killer," employing the weapon effectively was proving to be a problem. A method of delivering a bomb on a moving target with the greatest degree of accuracy was sorely needed. Dive-bombing provided the answer.

Prior to 1926, most dive-bombing trials had seen aircraft attacking stationary targets – an unrealistic scenario for maritime operations. To simulate real ship maneuvers, VF-5, flying F6C-3 fighters, conducted a series of dive-bombing attacks on target platforms towed by destroyers doing 20 knots. Armed with miniature practice bombs, the Naval Aviators of VF-5 obtained an impressive 36.2 percent hit rate from heights of 500 to 1,500ft. The test also revealed that aircraft were damaged by their own bombs hitting propellers and landing gear. The solution to this problem was found in the design and construction of bomb displacing gear, sometimes called a bomb fork or crutch. It simply swung the bomb forward and away along the centerline of the aircraft, clearing the propeller and wheels. It also allowed for the carriage of real bombs in the 500 to 1,000lb range. Flight-tested in 1931, the "crutch" was approved for service with all dive-bombers.

By the early 1930s the Bureau of Aeronautics (BuAer) had begun experimenting with monoplane designs. While a single wing offered the possibility of greater speed and range, it created a higher stalling speed and lengthened take-off run. US Navy pilots were consistent in their message to the BuAer. They were unwilling to wrestle with the higher deck landing speeds of monoplane carrier aircraft unless the top speeds achieved by these new types far outstripped those of existing biplanes.

Fleet exercises in 1932 also demonstrated the importance of locating enemy carriers and striking first. Most Naval Aviators realized that a fast, well-armed (500lb bomb) scout aircraft could attack an enemy carrier shortly after being sighted. Taking the advice of the fleet, BuAer converted the two-seat Curtiss F8C, Vought SBU-1, and Grumman SF-1 biplane fighters then under construction into a new class of aircraft – the scout bomber. Maximum bomb load was increased from two 100lb bombs to a single more powerful 500lb weapon.

The US Navy received 124 Vought SBU-1/2s from November 1935, and these aircraft were used as scout bombers, rather than as fighters as had originally been intended. This example was assigned to VS-1B, part of the air group embarked in USS *Ranger* (CV-4). (NHHC)

Carrier aircraft armed with torpedoes or 500 to 1,000lb bombs now had the ability to sink ships well beyond the range of naval gunfire. In terms of striking power and accuracy, the dive-bomber was the deadliest. In terms of explosive power delivered, a standard 14in. shell fired from a 14in./45-cal. gun on board a US Navy battleship contained just 470lb of explosive charge. A 1,000lb

Mk 5 bomb contained 771lb. The expensive battleship with a crew of more than 1,000 men would soon prove obsolete. Cheap, mass-produced carrier-borne aircraft could now deliver high explosive weaponry more accurately and at a greater range than the "big gun" battleship.

By 1941, the Tactical Orders and Doctrine for the three newly created fleets of the US Navy clearly stated, "Carrier-based aircraft are essentially offensive weapons. Once the enemy is located all other considerations are secondary to the delivery of heavy bombing and torpedo attacks. The surest and quickest means of gaining control of the air is the destruction of enemy carriers."

In 1934, the BuAer held a design competition for the next generation of carrier aircraft. The US Navy wanted all-metal monoplanes, with enclosed cockpits and retractable landing gear. Four new types were proposed: a single-seat fighter, a two-seat light scout bomber (500lb bomb load), a two-seat heavy dive-bomber (1,000lb bomb load), and a three-seat torpedo/horizontal bomber. Both bombers were to have a stalling speed of 65mph, be capable of achieving a stable vertical dive, and withstand a 9g pullout with a full bomb load. The scout and dive-bombers had an added specification – a speed brake to stabilize airspeed in a dive, thus making the aircraft a better aiming platform.

This BT-1, seen in a dive (with its split trailing-edge flaps open), was assigned to VB-5. This unit, which was part of *Yorktown*'s air group, was the first to receive the Northrop dive-bomber in April 1938. It switched to SBD-3s in late 1941. (NHHC)

Six manufacturers submitted proposals, but the two from Great Lakes and Curtiss were quickly dropped because they were biplanes. The remaining four companies – Northrop, Vought, Martin, and Brewster – all submitted designs. The most advanced entry was Brewster's XSBA-1, with a top speed of 250mph and an internal bomb-bay. However, because of the pressure to deliver its F2A Buffalo carrier fighter, Brewster was unable to build production examples of the aircraft. The US Navy duly stepped in and acquired the license to produce the aircraft at the Naval Aircraft Factory in Philadelphia, Pennsylvania. A total of 30 SBN-1s were built in 1940–42, and they briefly served with VB-3 aboard *Saratoga* and as training aircraft with VT-8 on board *Hornet*.

The second finalist was the Vought SB2U-1. Equipped with folding wings and fully retractable landing gear, the Vindicator was a mediocre aircraft and never a true dive-bomber. In total, 169 SB2U-1/2/3 were built between 1937 and 1941. SB2U-3s serving with the US Marine Corps saw limited action in the Pacific during 1942.

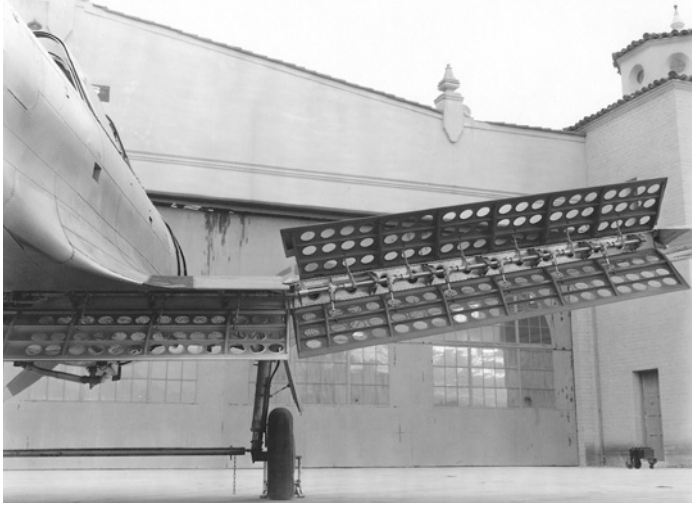
From the beginning, Northrop decided that a single airframe powered by a 825hp Pratt & Whitney R-1535-94 Twin Wasp radial engine could meet both sets of specifications for a scout and heavy dive-bomber. With the proposal accepted by BuAer, the company began designing a dive-bomber with the designation XBT-1. Northrop's chief engineer, Ed Heinemann, produced a streamlined aircraft with semi-retractable landing gear. To save weight and produce a wing strong enough for the dive-bombing mission, Northrop deleted any folding wing mechanism. To

partially compensate for this, the company created a small bomber that was not much larger dimensionally than the Grumman F4F Wildcat fleet fighter then also under development.

The most difficult problem facing Northrop and the other manufacturers was the specified speed of under 250 knots (287mph) in a vertical dive. Heinemann designed and installed split flaps along the trailing edge of the wing to act as dive brakes. Testing revealed the horizontal stabilizer suffered from severe flutter while in a dive, but following consultation with the National Advisory Committee on Aviation, this problem was solved. By drilling 3in. holes in the flaps, air was allowed to pass through them when they were extended, thus eliminating excessive buffeting of the tail due to disturbed air flow and increasing the XBT-1's dive angle. It was a milestone development, and one that would turn the SBD into the war's best dive-bombing platform.

The XBT-1 began testing in December 1935, and in early 1936 the US Navy placed an order for 54 aircraft, designated BT-1. Three squadrons would subsequently be equipped with the dive-bomber from April 1938, with two of them embarking in USS *Yorktown* (CV-5) and *Enterprise* pre-war. The BT-1 proved to be a disappointment operationally, suffering from poor lateral stability and a tendency to torque stall with the sudden application of power at slow speeds. Heinemann concluded that a new rudder modification was needed. This and other changes resulted in the XBT-2.

The new model did not make it into production under the Northrop banner. In 1937 the Douglas Aircraft Company was given the dive-bomber contract, and most of those involved, including Heinemann, moved to California after Northrop became the El Segundo Division of Douglas. The new XBT-2 was powered by an 800hp Wright R-1820-32 radial engine driving a three-blade constant-speed propeller, which, combined with the improved streamlining of a fully retractable undercarriage, gave the aircraft a top speed some 35mph faster than the BT-1. Test pilots were also impressed with the XBT-2's improved stability and overall handling characteristics, the new aircraft featuring "letter box" anti-stall slots in the leading edge of each wing that made the dive-bomber easier to control when approaching its stalling speed of 78mph.



The SBD-2's split trailing-edge flaps, which doubled as dive brakes, are seen here at full extension – the dive flaps are above the wing and the landing flaps below. The large, tennis ball-sized holes allowed the slipstream to pass through the flaps without disturbing airflow over the tail surfaces. These flaps allowed the SBD to maintain an even 240mph during the dive phase of an attack. (NARA)

Shortly after its maiden flight in August 1938, the Douglas-built machine was given the new designation XSBD-1, with SBD standing for Scout Bomber Douglas. The prototype was then flown to Anacostia, in Washington, D.C., where it completed extensive trials. This was followed by full scale wind tunnel testing at Langley Field, Virginia.

The XSBD-1 was a huge improvement over the BT-1, and in April 1939 Douglas received an order for 144 SBDs – 57 SBD-1s for land-based squadrons of the US Marine Corps and 87 SBD-2s (with increased fuel capacity) for units assigned to the US Navy's carrier air groups.

The delivery of the first SBD-1 (to VMB-2) in late 1940 was a milestone for the BuAer's 14-year effort to produce and procure a true multi-role carrier aircraft. Naval Aviators now had a machine that could perform two missions – dive-bombing and armed scouting – equally as well. Indeed, the SBD's large internal fuel capacity made it well suited for long-range scouting; a key role in the success of any carrier operation. IJNAF doctrine relied on a mix of unarmed cruiser-launched floatplanes and carrier-based aircraft to fulfil long-range search requirements.

The evolution of the XBT-1 (BuNo 9745) into the XBT-2 (BuNo 0627). Powered by a Wright R-1820-32 radial engine, the XBT-2 first flew on April 25, 1938. Top speed of the latter machine was 265mph, compared with 222mph for the Pratt & Whitney R-1535-94-powered XBT-1. (NHHC)

Although the SBD provided the fleet with good endurance and range, the problem of navigating over the featureless ocean severely restricted its operational search radius. Under normal flying conditions, a Dauntless pilot could expect to accumulate a navigation error of approximately two miles for every 100 miles flown. After a 300-mile search, he would most likely miss his carrier by some 12 miles or more. This would place the returning aircraft well beyond visual range of the carrier, forcing the crew to initiate a standard box search. For that eventuality, a three-hour fuel reserve was required.

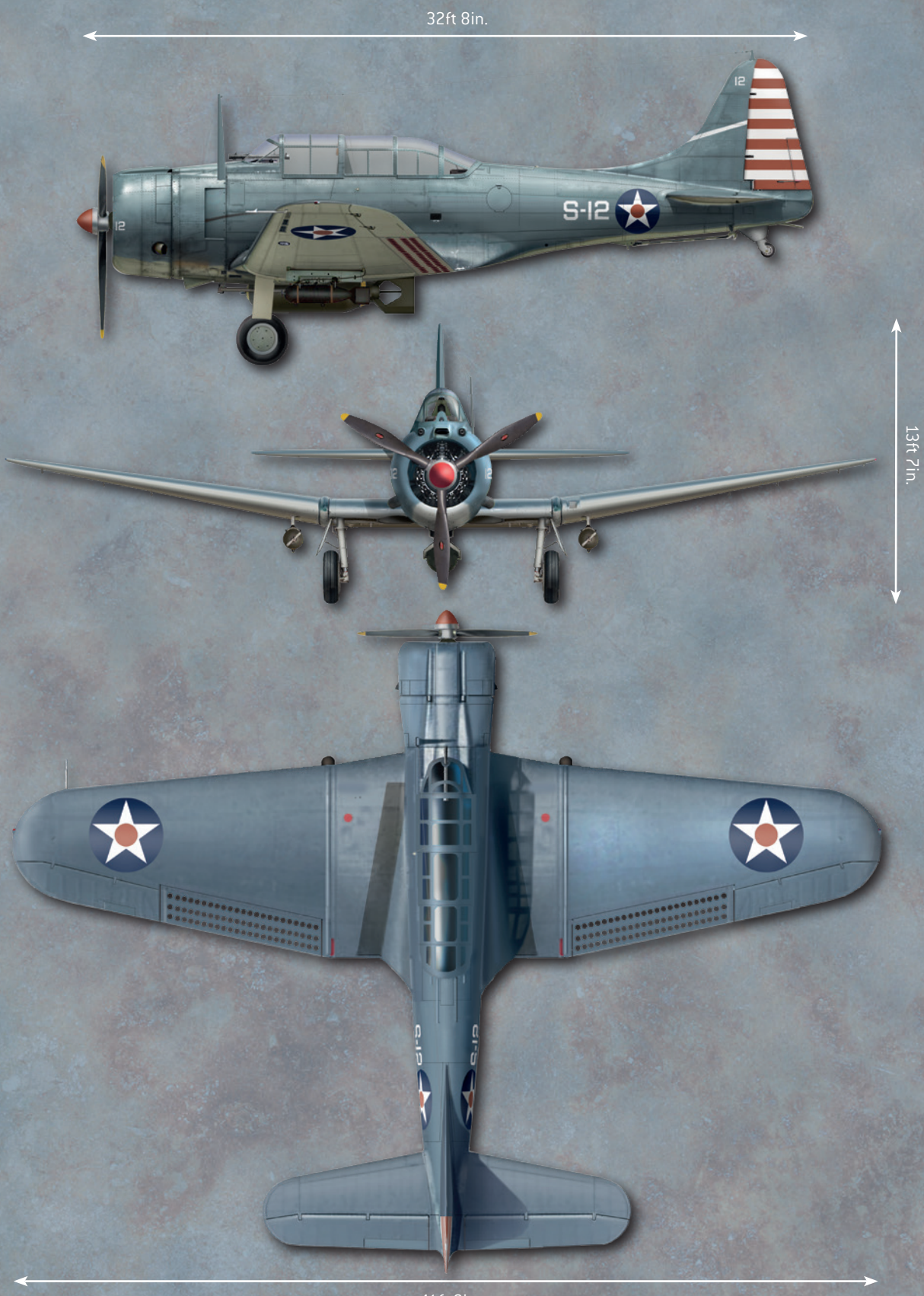
During tactical exercises held in the 1930s, the need to equip carrier aircraft with a homing device was proven again and again. Adm Joseph M. Reeves, Commander-in-Chief, US Fleet in 1934–36 and an early proponent of US Naval Aviation, stated "No Fleet commander will abandon his aircraft without making strenuous efforts to get them back to their parent carrier." He recommended the development of a radio homing beacon as a top priority. Reeves' concerns were already being addressed by the Bureau of Engineering and the National Research Laboratory (NRL).

By the summer of 1938, the NRL was testing a full-scale homing prototype with the help of VF-4 flying from the carrier USS *Ranger* (CV-4). Known as "hayrake," due to the shape of the ship's antenna, the new system consisted of an ultra-high frequency radio transmitter (YE) onboard the carrier and a special receiver (ZB) installed in all aircraft. The YE-ZB radio homing system worked so well it could bring a pilot back to within 500 yards of the carrier. By the end of 1940 deliveries of YE-ZB components were well underway, with equipment being installed on all US Navy carriers. The first ZB units appeared in aircraft in February 1941.

This, along with other electronic devices, provided the US Navy with a number of force multipliers. Indeed, the development of radar and IFF (Identification Friend or Foe) gave US carriers a degree of control over the battlespace the IJN would never be able to match. ZB equipment was like adding another fuel tank, giving the Dauntless the ability to operate at its maximum performance.

As previously noted, the SBD-1 entered service in late 1940 when MAG 1's VMB-2 received its first examples, whilst the US Navy accepted its first batch of SBD-2s in early 1941 – by May of that year, all 87 "Dash Twos" had been delivered.

SBD-3 DAUNTLESS



Rapidly changing requirements requested by the US Navy for its combat aircraft led to the delivery of the SBD-3 from March 1941 – 584 were built in total. It managed to shed 180lb, but kept all the "Dash Two's" modifications and saw the size of its cowling guns increased from 0.30-cal. to 0.50-cal. without additional weight. Self-sealing tanks and extra protective armor were also installed following feedback from naval attachés in Europe. Finally, the aircraft was fitted with a 1,000hp Wright R-1820-52 engine. Next in line was the SBD-4 (780 built for the US Navy), which, other than featuring an improved 24-volt electrical system, was near-identical to the "Dash Three."

With war clouds gathering in the Pacific, Douglas had managed to up production of the SBD to 20 aircraft a month by the end of 1941. When running at peak efficiency, the Douglas plant at El Segundo would crank out an amazing 11 Dauntlesses a day.

The SBD-5 was built following a request by pilots for more power. When fully loaded, the SBD-3/4 had to operate at nearly maximum power for the majority of the mission. Equipped with an improved Wright R-1820-60 engine, the "Dash Five" (2,409 examples of which were accepted by the US Navy) developed 1,200hp on take-off. Built at the new Douglas plant in Tulsa, it was also the first SBD variant delivered with a factory-installed twin 0.30-cal. gun mount. All previous models had had the rear guns fitted in the field. The final Dauntless model was the SBD-6 (451 built for the US Navy), equipped with the 1,350hp R-1820-66 engine. By the time it entered production in late 1943, the problematic Curtiss SB2C Helldiver was finally ready for operational service and began to replace the reliable SBD onboard the US Navy's fleet carriers.

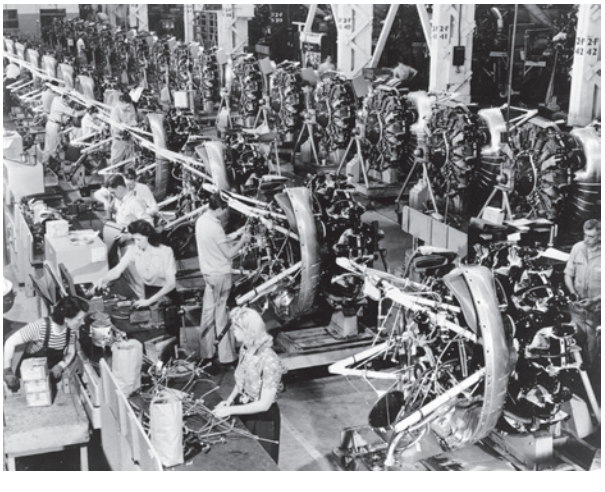
For all its inherit qualities as a dive-bomber, the SBD was not the aircraft the US Navy wanted to fight the Pacific War with. It was the SB2C Helldiver. Built to a 1938 design specification, the large, ugly Curtiss airframe suffered from a long gestation period due to handling issues and myriad design changes. By the time the Helldiver made its combat debut in November 1943, the aircraft's impact was not nearly as great as the SBD's had been during 1942.

The Dauntless was not without its faults, however. Relatively slow, it was also noisy and drafty, and some considered it under armed. As described by Capt Bruce Prosser of VMSB-232, the SBD had only one bad habit. "The old girl had a particular characteristic – in a tight vertical left hand turn, she stopped flying without warning and her nose dropped quickly and significantly." Under a full load, the SBD earned the nicknames "the Barge," "the Clunk," or "Speedy-D." The best remembered, and most accurate, was "Slow But Deadly."

During its relatively short combat career, the Dauntless was unquestionably the war's greatest dive-bomber. No aircraft did more to bring about Allied victory in the Pacific War than the SBD. With no serious vices, the Dauntless was rugged, easily maintained, and capable of absorbing a great deal of punishment and still get its crews to safety.

OPPOSITE

Following the IJNAF attack on Pearl Harbor, and the many friendly fire incidents that occurred both during and after the raid, the need for more visible markings on US Navy aircraft led to the issuing of a new directive. The tri-color insignia was now to be placed in six locations – both sides of the fuselage and the top and bottom of both wings. The insignia was also enlarged, but varied in size between squadrons. In addition, red and white horizontal stripes were added to the rudder from January 5, 1942. This particular SBD-3, BuNo 4547, of VS-2 was flown from *Lexington* by Ens John Leppla and radioman-gunner ARM2c John Liska during the Battle of the Coral Sea. This aircraft was lost in the south Pacific on December 31, 1942 while serving with VS-8.



Wright R-1820-60 engines, complete with their tubular fuselage bearers, have hydraulic lines fitted on the production line at El Segundo in August 1943. Once ready, they would be installed in SBD-5s. Douglas could complete 11 Dauntlesses a day when running at peak output. (NHHC)

For Lt Cdr Maxwell F. Leslie, CO of VB-3 (embarked in *Saratoga* and then *Yorktown* in 1942), the SBD was a war winner. "There were many types of military planes used in World War 2, with any of them being recalled as the most effective against the enemy, but in my opinion, there isn't a doubt that the SBD should be near the top of the list."

MITSUBISHI A6M ZERO-SEN

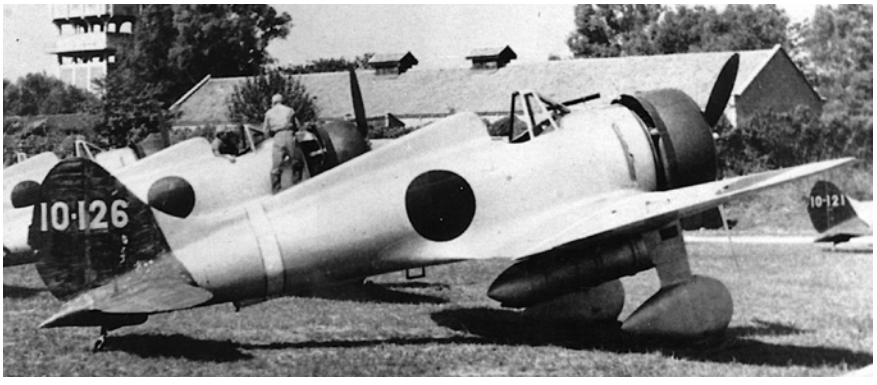
In mid-1937, the IJNAF issued specifications for a new carrier-based fighter, the 12-shi. The performance requirements were far in excess of those of the Mitsubishi A5M, which was just beginning to enter service. Japanese success with the nimble A5M over China during the Sino-Japanese "Incident" in 1937 reinforced a strong belief among IJNAF pilots that any future fighter type needed to be highly maneuverable so that it would prevail in tight-turning air-to-air combat. The lessons learned in the skies over China would, ultimately, not serve the new fighter well. The belief that a light, nimble, fighter would dominate the skies was not only reinforced, but cemented into Japanese design philosophy.

Conversely, the Allies had learned that maneuverability was the least important attribute when it came to fighter design. Sharp turns in combat meant a loss of speed and altitude. They were, in effect, a defensive manoeuvre. Japanese designers were also highly influenced by their combat-experienced pilots, especially those of the Yokosuka Naval Air Corps.

"Planning Requirements for Prototype 12-shi Carrier-based Fighter" were sent to the Mitsubishi Kokuki K.K. (Mitsubishi Aircraft Company Ltd) and the Nakajima Hikoki K.K. (Nakajima Aeroplane Company Ltd.) on October 5, 1937. The specifications, listed below, were seen by many as being far in excess of industry capabilities at that time;

Mission	A fighter capable of both intercepting and destroying enemy attack bombers and undertaking the bomber escort mission, with combat performance greater than that of enemy interceptors.
Speed	Maximum speed exceeding 310mph at 13,123ft in level flight.
Climb	Climb to 9,843ft within 3 min 30 sec.
Endurance	Normal flight duration of 1.2 to 1.5 hours with normal rated power (maximum continuous) at 9,843ft fully loaded with auxiliary fuel tank.
Maneuverability	Equal to or better than Type 96 A5M fighter.
Armament	Two Type 99 20mm cannon Mk 1 Model 3, and two Type 97 7.7mm machine guns.
Radio	Type 96-ku-1 airborne radio and Type Ku-3 radio homer.

Nakajima quickly withdrew, convinced the job was beyond its expertise. Mitsubishi at the time was in the process of developing the IJNAF's 11-shi bomber, and it was



The A6M Zero-sen was intended to replace the A5M Type 96 Carrier Fighter, four of which (from 15th Kokutai) are seen here at Anking, in China, in the summer of 1938. Initially, IJNAF pilots were reluctant to transition from the well liked A5M to the new Zero-sen, as in mock dogfights with the latter fighter the Type 96 won every time. However, the spectacular first combat success enjoyed by the A6M in September 1940 changed pilots' minds once and for all. (Tony Holmes Collection)

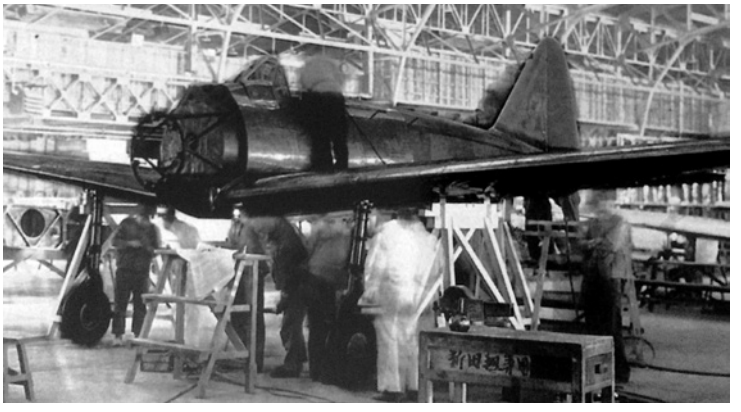
extremely reluctant to invest resources into something the company believed had little hope of success. To "sweeten the pot," the IJNAF allowed the company to drop the 11-shi program in order for it to concentrate on the new fighter project. Under these strict circumstances A5M designer Jiro Horikoshi and his team created a minor miracle.

In order to produce what was in essence a "super A5M," Horikoshi and his designers knew that keeping the new fighter's weight down was the key to success. From the outset, however, they were handicapped by available horsepower. Japanese engines at that time were only capable of producing 800 to 1,000hp. There were a number of promising powerplants in the design and experimental development stages, but to move forward as per the IJNAF's strict delivery schedule Horikoshi and his team needed a reliable engine immediately. At the time there were three radial engines that fit the bill – the 875hp Mitsubishi Zuisei 13, the 950hp Nakajima Sakae 12, and the 1,070hp Mitsubishi Kinsei 46. The first two prototypes would be fitted with the Zuisei 13 engine. In comparison, the SBD-1 was powered by a 1,000hp Wright R-1820-32 engine.

With weight saving being the first priority, the wing was built as one piece using a unique lightweight zinc-aluminum material called Extra Super Duralumin (ESD) that had recently been developed by the Sumitomo Metal Company. Thinner sheets of ESD were also used for the fighter's skinning. Items that added unnecessary weight (armor plating and self-sealing fuel tanks) and drag were eliminated.

On March 23, 1939, the 12-shi prototype was taken apart, loaded onto two oxcarts and moved to the naval air base 30 miles away at Kagamigahara for its first flight. Powered by an 875hp Mitsubishi Zuisei 13 engine, the new A6M1 prototype took to the air on April 1, 1939. On May 1, Horikoshi was advised that the IJNAF intended to replace the Zuisei 13 engine with the 950hp Nakajima Sakae 12. The 14-cylinder radial, which was equipped with a single-stage supercharger, was only slightly larger in diameter than the Zuisei 13. First installed on the third prototype, the Sakae would power almost every model of the Zero-sen fighter until the final months of the war. At the same time the IJNAF designated the first and second prototypes of the 12-shi fighter, the A6M1 and the Sakae-powered model the A6M2.

Aerodynamically the Zero-sen was a brilliant design. Saburo Sakai, one of the IJNAF's leading aces, was full of praise for the aircraft. "The Zero excited me as nothing else had ever done. Even on the ground it had the cleanest lines I had ever seen in an aeroplane. It was a dream to fly." Because of its light weight relative to



An early-build A6M2 Model 11 airframe nears completion on Mitsubishi Jukogyo K.K.'s Nagoya production line in 1940 – the company built 98 A6M2s during the course of that year. (Tony Holmes Collection)

engine power, clean design and high-lift wings, the Zero-sen was one of the most maneuverable fighters of World War II. At speeds below 200mph it could out-turn and out-climb any Allied fighter with ease. The aircraft also had a nasty bite. Armed with two Type 99-1 20mm cannon and two Type 97 7.7mm machines guns, the Zero-sen had a powerful punch. The fighter's light weight also had a positive effect on its range. The Zero-sen was extremely fuel-efficient, and as a result it had a radius of action of more than 550 miles. During the fighting in the Solomons in the late summer of 1942, the Zero-sen was the only fighter in the world then capable of flying the 560 miles from IJNAF airfields at Rabaul to Guadalcanal.

The first Zero-sens to engage in combat were those of 12th Rengo Kokutai (Combined Naval Air Corps) over China. On September 13, 1940, 13 A6M2 Model 11s escorted a small force of bombers targeting the city of Chungking. Having seen the bombers deliver their ordnance and set course for home, the Zero-sen pilots returned to the city to find 30 Polikarpov I-15bis and I-16 fighters circling overhead the target area. In a ferocious ten-minute air battle, the IJNAF pilots claimed 27 Chinese fighters shot down. The RoCAF admitted to 13 aircraft destroyed and 11 damaged.

By the end of 1940 pilots flying the Zero-sen had claimed 59 fighters shot down and an additional 101 destroyed on the ground, all for the loss of just three aircraft to ground fire. The legend of the Zero-sen's invincibility originated with its performance in China. Indeed, the extreme confidence generated by the aircraft's initial success gave IJNAF commanders an unshakable faith and belief that all future military operations would be equally as successful.

Carrier trials with the Zero-sen had revealed that it only just fitted onto elevators that took aircraft from the flightdeck down to the hangar bay, leaving wingtips susceptible to damage. Like the SBD Dauntless, the A6M was not equipped with folding wings. To address the issue, Mitsubishi fitted folding wingtips beginning with the 65th production aircraft. This led to a change in designation, with this and subsequent aircraft being designated the Model 21. Had the wings been made to fold fully, IJN carriers could have carried more fighters, but due to severe weight restrictions imposed on the design, a folding wing was never considered.

By the time the IJNAF went to war on December 7, 1941, the A6M had replaced the older A5M in almost all of its fighter units. During 1941 the Mitsubishi delivered 409 Zero-sens to the IJNAF – an incredibly small number of fighters with which to start a major war, but such was the faith in the Zero-sen that Japanese commanders believed it was the equal of two to five enemy fighters. In an ironic turn, given its earlier withdrawal from the competition, Nakajima was also ordered to begin production of the Zero-sen – the firm delivered its first aircraft to the IJNAF in November 1941.

OPPOSITE BOTTOM

On December 27, 1942, this A6M3 of Tainan Kokutai was found abandoned at Buna airstrip in New Guinea by Allied troops. It was subsequently shipped via barge to Brisbane, in Queensland, where the aircraft was returned to airworthiness through the incorporation of missing parts obtained from other abandoned Zero-sens at Buna. Test flown in Australia during the summer of 1943, the A6M3 was then shipped to the US in September–October of that same year. By November 1 it was at Wright Field, in Ohio, where it received full USAAF insignia and the code EB-201. The A6M3's distinctive squared-off wingtips are clearly visible from this angle. (NARA)

During the early months of 1942 the A6M2 Model 21 proved an effective and deadly fighter. From Pearl Harbor to the Philippines and Wake Island to northern Australia, the Zero-sen established a reputation like no other. Its phenomenal range caused great confusion and consternation among Allied commanders. On December 8, 1941, Clark and Nichols Fields in the Philippines were decimated by IJNAF bombers escorted by Zero-sens from 3rd and Tainan Kokutais. The Americans were convinced the fighters had been launched from a nearby carrier. In fact, these Zero-sens were operating from bases on Formosa, a round trip of 900 nautical miles.

Its wingtips carefully folded up, a brand new Nakajima-built A6M2 Model 21 is slowly lowered onto a lighter from the auxiliary transport *Mogumigawa Maru* off Truk during the fall of 1942. (Tony Holmes Collection)

In October 1942 the next major variant of the A6M made its operational debut. To compete with the expected increase in performance of Allied fighters and bombers, the Zero-sen's altitude and climb performance had to be addressed. IJNAF pilots had also been vocal in their complaints about the A6M2's poor lateral control at high speeds. As air speed increased above 180mph, aileron response deteriorated rapidly, and above 230mph, the Zero-sen became difficult to roll.

The new 1,130hp Sakae 21 engine, which featured a two-stage, two-speed supercharger, was fitted, while a change in reduction gearing allowed for the installation of a larger propeller. Despite the increase in power, the new Zero-sen's performance remained static, however. After initial flight-testing, pilots recommended eliminating the wing-folding mechanism and fairing over the wingtips. In shortening the wing by around three feet, the Mitsubishi engineers also shortened the ailerons. This combination improved aileron control, roll rates, and the fighter's performance in a dive at higher speeds for a relatively small loss in overall maneuverability and rate-of-climb.

With both a revised fuselage and a new engine, the A6M3 was designated the Model 32. Disappointingly, the Zero-sen Model 32 proved to be only marginally faster than the Zero-sen Model 21, due in part to the added weight of the new engine and increased ammunition for the Type 99-1 cannon. More critically, although the capacity of the two wing fuel tanks was increased slightly, a reduction in the size of the fuselage fuel tank reduced the overall fuel capacity. As the Sakae 21 had higher fuel consumption than the Sakae 12, this reduced the Zero-sen Model 32's range.

Entering production in early 1942, when it was given the Allied reporting name "Hamp," the Model 32 went into action over New Guinea and the Solomon Islands later that year.

A6M2 ZERO-SEN MODEL 21

In response to the problems encountered with the Model 32's reduced range, Mitsubishi hastily fitted 9.9-gallon fuel tanks in each wing outboard of the cannon bay and restored the folding wingtips in order to retain a low wing loading, despite the increased weight of the additional fuel. This variant was known as the A6M2 Model 22, or Model 22A (A6M3a) when long-barrel 20mm Type 99 Model 2 Mk 3 cannon were installed. The additional fuel gave the Model 22 the greatest range of all Zero-sens, and examples began to reach the Solomons in late 1942.

In a flight test report of a captured example dated March 28, 1944, the USAAF described the "Hamp" as follows:

> The Japanese, AAF No. EB-201, is a low-wing single-engine fighter of all-metal, stressed skin design. The fuselage is in two sections joined aft of the pilot's compartment. The forward section is of semi-monocoque construction, the rear section is full monocoque. The wings are integral with the forward section of the fuselage.
>
> The airplane is highly maneuverable, has a fair rate of climb, and good visibility; however, its speed in level flight is low, it is lightly armed, has no armor protection for the pilot, and the fuel tanks are not self-sealing. The cockpit layout is fair, leg room is insufficient for an average sized man and application of the brakes with fully extended rudder is impossible.
>
> Vision [from the cockpit] was considerably better than in AAF fighters. Visibility was fair for taxiing and good in climb, level flight, and glide. Vision to side, below, and above was good, and vision to the rear was satisfactory, although the airplane was not equipped with a rear-view mirror. The cockpit layout was fair. The flight instrument arrangement was good. The landing gear and flap control levers were located on the right rear side of the cockpit and their operation was awkward. There was not sufficient legroom for the average pilot, although the cockpit was probably sufficient for the average Japanese pilot. Rudder applications was extremely difficult, and the use of a rudder bar made it impossible to apply the brakes when the rudder was fully extended. There was ample shoulder and head room for even a large pilot.

By war's end, the Zero-sen remained essentially the same aircraft. In 1944–45, most units were equipped with the A6M5 Model 52 and its sub-variants, the 52a, 52b, and 52c, although clashes between such aircraft and the SBD were few and far between. The new model, introduced in the summer of 1943, was designed to streamline production and increase the aircraft's speed in a dive. To achieve the latter, new wings with heavier gauge skinning and redesigned non-folding rounded wingtips were fitted. All four variants (which primarily differed in their armament) were powered by the Sakae 21 engine developing just 1,130hp. Another measure introduced to improve the fighter's speed was the replacement of the exhaust collector ring with individual stacks, which directed high-velocity exhaust gases rearward for additional thrust. In the end, the new Model 52 had a top speed of just 351mph at 19,700ft – a 20mph increase over the Model 21. The Model 52 was the most widely used variant of the Zero-sen series.

OPPOSITE
This A6M2 is representative of the Zero-sens flown from *Shokaku* during the key carrier actions of 1941–42. During combat operations the attrition rate of carrier aircraft was high – some were shot down, while others were lost due to landing accidents, fuel starvation, errors in navigation compounded by poor weather, and battle damage. Indeed, heavily damaged aircraft were simply pushed over the side, rather than being repaired. Although air group leaders and buntaicho routinely flew their assigned aircraft (marked with command stripes on the fuselage and tail), remaining pilots usually flew whatever fighter was available, such as this Zero-sen. The "EI" code on its tail was excusively applied to aircraft assigned to *Shokaku*'s air group, with the "E" denoting the vessel's carrier division (in this case Carrier Division 5) and the Roman "I" being specific to *Shokaku*. The "1" in "128" was the number assigned to fighters – "2" was used by dive-bombers and "3" horizontal/torpedo-bombers.

TECHNICAL SPECIFICATIONS

SBD DAUNTLESS

In early 1934 the US Navy initiated a series of design competitions for the development of a new monoplane fighter, torpedo-bomber, and dive-bomber for service aboard *Saratoga*, *Lexington*, and the soon to be commissioned *Ranger*. The end result of these competitions would be the introduction of the US Navy's first monoplane carrier aircraft in the form of the Douglas TBD-1 Devastator torpedo-bomber, followed by the Northrop BT-1 and Vought SB2U Vindicator dive-bombers and, finally, the Brewster F2A Buffalo fighter. By 1939 the US Navy's carrier fleet was almost fully equipped with modern monoplane fighters and bombers. These aircraft were soon followed by more effective types, specifically Grumman's F4F Wildcat and TBF Avenger and the redoubtable SBD Dauntless.

SBD-1

The Dauntless was a small aircraft, being not much bigger than the single-seat F4F Wildcat. During its production, the SBD went through only minor modifications that saw the fitment of more powerful versions of the Wright Cyclone radial engine, improved armor protection for the crew, and additional guns installed.

All Dauntlesses were built in four sections – nose, fuselage, empennage, and wing assemblies. The nose section held the mounting frame for the Wright R-1820 engine. The fuselage structure was of all-metal, stressed-skin semi-monocoque construction. The

cockpit was fully enclosed, with a continuous transparent canopy. The radioman/gunner was equipped with a set of duplicate flight controls consisting of a control column, rudder pedals, flight instruments (airspeed indicator, altimeter, clock and compass), and throttle. Wings were all metal, multi-cellular stressed skin construction, with fabric covered ailerons. The landing gear was hydraulically powered and retracted inwards flush with the bottom of the wing surface to reduced drag. The struts were faired over but the wheels remained exposed. The empennage was built out of metal and attached to the rear fuselage assembly. The rudder and elevators were constructed of aluminum framing, and were fabric covered. The empennage housed the tailhook and non-retractable pneumatic tail wheel. To control the speed of the aircraft in a dive, perforated split dive flaps were installed along the wing's trailing edge and underside of the fuselage. The lower flaps were depressed 40 degrees and the upper wing flaps raised 37.5 degrees in a dive. This allowed the SBD to dive at a terminal velocity of some 240mph.

The distinguishing feature of the SBD-1 was its larger carburetor air scoop on top of the cowling that housed the 1,000hp Wright R-1820-32 engine. Armament consisted of two forward-firing 0.30-cal. machine guns mounted on top of the cowling directly in front of the pilot and a single 0.30-cal. drum-fed flexible rear gun for the radioman/gunner. The butts of the forward-firing AN-M2s projected into the cockpit, allowing the pilot to clear jams and recock the guns. Maximum bomb load was 1,200lb. The SBD-1 was fitted with the Mk III Mod 2 three-power telescopic sight, which the pilot used for both dive-bombing and air-to-air combat.

Floatation equipment was fitted on both sides of the forward fuselage, the bags being inflated with CO_2 gas that was automatically released by actuators located on the upper and lower surface of the fuselage when either actuator was subjected to pressure from between 18 to 30 inches of water. Although this was standard equipment on the SBD-1/2, it was deleted from the SBD-3 onward. Radio equipment for the Dauntless consisted of the US Navy's high frequency ARA/ATA aircraft-to-aircraft and aircraft-to-ship system.

The SBD-1 was not a combat ready aircraft, as it lacked armor plating for the crew and self-sealing tanks. The latter were capable of holding only 210 gallons split between four tanks. Maximum strike range with a 1,000lb bomb was just 860 miles, whilst its scouting range was 1,165 miles. The first of 57 SBD-1s entered service with the US Marine Corps in late 1940. Eight examples were fitted with cameras and redesignated SBD-1Ps.

The SBD-2's cowl-mounted twin 0.30-cal. machine guns offered a good concentration of firepower, making aiming easier for the pilot. These weapons were replaced with 0.50-cal. Brownings from the SBD-3 onward. The telescopic sight was used on all Dauntless variants from the "Dash One" through to the "Dash Four." The key numbers in this manual photograph denote the air baffle (1) and forward barrel support (2). (NARA)

SBD-2

In an unusual move, the US Marine Corps was issued with the entire SBD-1 production run, as the US Navy had quickly realized that the aircraft was not suitable for combat operations from carriers. BuAer duly instructed Douglas to implement changes to improve the Dauntless, and 87 examples of the resulting SBD-2 were ordered. Fuel was increased by 50 percent with the installation of two 65-gallon fuel tanks in

the outer wing sections – these remained non-self-sealing, however. Total fuel capacity was now 310 gallons, giving the SBD-2 a bombing range of 1,225 miles and a scouting range of almost 1,400 miles. Some armor plate for the pilot was added, along with a bulletproof windscreen. The aircraft was also equipped with a Sperry autopilot. Entering service in early 1941, the SBD-2 was powered by the same R-1820-32 engine as the "Dash One," giving the aircraft a top speed of 252mph. Fourteen airframes were fitted with cameras and redesignated SBD-2Ps for the photo-reconnaissance role.

SBD DAUNTLESS FIXED MACHINE GUNS

The forward armament of the Dauntless initially consisted of two AN/M2 0.30-cal. machine guns in the SBD-1/2, although these were replaced by a pair of 0.50-cal. Browning M2s from the SBD-3 onward. Each carried 360 rounds per weapon, belt fed via stainless steel ammunition feeds. The principal role for these guns was the suppression of anti-aircraft fire when diving on an enemy vessel, as well as strafing. Their use in air-to-air combat was not the guns' primary purpose, and the inadequacy of the Mk III telescopic gunsight did little to help the cause of would-be SBD aces. The weapons' rate of fire was controlled via interrupter gear to prevent rounds hitting the propeller. Capable of firing 750–850 rounds per minute, a two-second burst of fire from the two guns would amount to the expenditure of about 26 bullets – not a lot when trying to hit a nimble Zero-sen. The terrible conditions encountered by SBD units ashore at Henderson Field during the battle for Guadalcanal meant the guns could be unreliable, often jamming at the most critical moment.

SBD-3

The SBD-3 was powered by a R-1820-52 engine that was again rated at 1,000hp. Entering service in March 1941, the "Dash Three" was the first truly combat-ready Dauntless, although plenty of SBD-2s also saw action in the first months of the Pacific War. Additional armor plating, weighing 168lb in total, was added for the pilot and radioman/gunner. The SBD-3 boasted four bladder-type self-sealing wing tanks for a total of 284 gallons, and a 58-gallon drop tank could be attached to the centerline in place of the bomb. Standard bombload was 1,200lb. The forward-firing 0.30-cal. machine guns were replaced by two 0.50-cal. weapons. Early production SBD-3s had a single 0.30-cal. flexible gun in the rear cockpit, but prior to the Battle of Midway all "Dash Threes" were retrofitted in the field with flexible twin gun mountings. Later factory-built aircraft had twin guns with large single ammunition boxes for continuous feed for the weapons. Forty-three SBD-3s were converted into SBD-3P photo-reconnaissance aircraft. Some 584 "Dash Threes" were built in total.

SBD-4

The SBD-4 was introduced into operational service in late 1942, this variant having improved radio navigation aids, an electric fuel pump, a 24-volt electrical system, and a Hamilton Standard Hydromatic constant speed, fully feathering propeller. It was also capable of being fitted with ASB search radar, although the system did not see widespread use until the advent of the SBD-5. A total of 780 SBD-4s were built at El Segundo, with the majority serving ashore with the US Marine Corps.

A-24/A/B BANSHEE

The USAAC's desire for a dive-bomber of its own led to the procurement of a de-navalized version of the SBD. The first A-24 Banshee was simply an SBD-3 with the arresting gear removed and the replacement of the solid rubber tail wheel with a pneumatic tire – 78 aircraft were delivered in 1941, followed by a further 90 in 1942. The A-24A, based on the SBD-4, was also acquired in 1942 (170 examples), with 615 SBD-5-inspired A-24Bs rolling out of the new Tulsa factory in 1943. Although ten bomb groups flew Banshees, and the aircraft saw action (including being engaged by Zero-sens) in Java, New Guinea and the Gilbert Islands in 1942–44, most A-24A/Bs were used for training.

This A-24, seen at Amberley Field in Queensland in early 1942, was one of 52 Banshees that had been destined for service with the 27th BG in the Philippines when war broke out with Japan. The ships carrying the dive-bombers (and P-40E fighters) were redirected to Brisbane, where they docked on December 23, 1941. All the USAAC aircraft were clearly marked with pre-war national insignia. (Michael Claringbould Collection)

SBD-5

The penultimate version to see combat was the SBD-5, built exclusively at the new Douglas plant in Tulsa. Engine power was

increased for the first time with fitment of the 1,200hp Wright R-1820-60. Fuel capacity was also increased to 370 gallons, giving the SBD-5 the best range – 1,565 miles – of any Dauntless. The old Mk III telescopic sight was replaced by the Mk VIII reflector gunsight. The SBD-5 was easily identified by the YAGI air-to-surface vessel radar aerials located under each wing. The associated radar scope was placed in the rear cockpit under the fixed section of the canopy. Empty weight of the SBD-5 was 6,533lb, making the "Dash Five" 630lb heavier than the SBD-1. Deliveries began in May 1943, with the last SBD-5 coming off the Tulsa production line in July 1944. In total, 2,965 SBD-5s were built, with 2,409 of these aircraft being supplied to the US Navy.

SBD DAUNTLESS FLEXIBLE-MOUNTED MACHINE GUNS

The radioman-gunner's armament in SBD-1s, -2s, and early-build -3s consisted of single, belt-fed 0.30-cal. Browning AN/M2 machine gun. However, prior to the Battle of Midway, fleet-assigned Dauntlesses were fitted with twin mountings in the field – the twin mount was simply two guns, their barrels eight inches apart, joined together by metal framework. The magazine for these weapons held 2,000 rounds, and the rate of fire for the twin mount was an impressive 2,400 rounds per minute. Muzzle velocity was 2,800ft per second, with an effective range of 300 yards. The 0.30-06 round was 3.34 inches long and weighed 2.1 ounces. Ammunition was fed into the left gun from the left side in the conventional manner. For the right gun, the feed mechanism was reversed.

SBD-6

The final version of the SBD family was the "Dash Six," powered by a 1,350hp R-1820-66 engine that gave it a top speed of 262mph. This made the SBD-6 the fastest Dauntless of them all. When the aircraft went into production in late 1943, the SB2C Helldiver was just making its combat debut in the Pacific. The big Curtiss dive-bomber would soon replace the much-loved SBD on board the US Navy's fleet carriers. On July 22, 1944, the last SBD-6, BuNo 55049, rolled off the Tulsa production line. Only 450 "Dash Sixes" were built, with the majority being assigned to training units in the US.

Just one of 2,965 SBD-5s built by Douglas at the company's Tulsa plant, this aircraft was assigned to VB-10 when it was photographed on April 29, 1944 heading for Truk after being launched from *Enterprise*. The dive-bomber is carrying a full load of external ordnance – a single 500lb GP bomb beneath the centerline and two wing-mounted 250lb GP bombs. (NHHC)

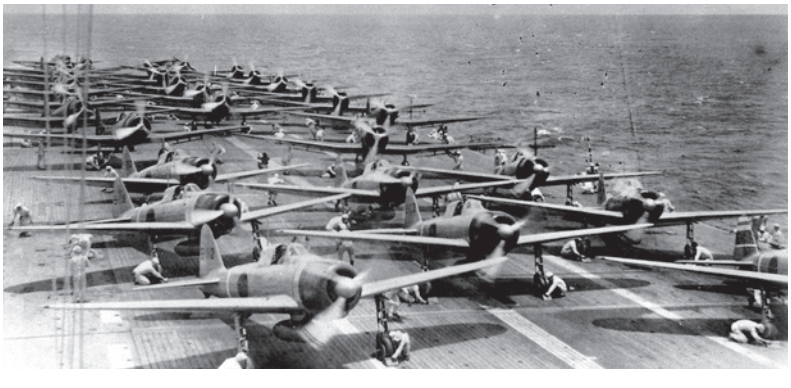
A6M ZERO-SEN

The A6M Zero-sen was arguably the best carrier fighter in the opening phases of the Pacific War, ranging far and wide in support of Japanese forces on all fronts. Pilots flying the aircraft quickly achieved ascendancy in the air, claiming many victories against all the Allied air forces. During the first year of the war, A6M2/3s were as fast as, or faster than, most Allied fighters in level flight, and appreciably more maneuverable. The Zero-sen's early success was due in large part to the well-trained pilots who flew it. Most IJNAF fighter pilots at the time of the attack on Pearl Harbor averaged about 800 hours of flying time, and many had combat experience from the conflict in China. As the war progressed, the Zero-sen's fighting qualities began to deteriorate, as did the quality of its pilots following heavy attrition during 1942–43.

Pilots strapped into their A6M2 Model 21s run their engines up on the deck of *Shokaku* (with "Val" dive-bombers behind them), waiting for the carrier to turn into wind so that they can take off during the Battle of the Santa Cruz Islands on October 26, 1942. A handful of SBDs were claimed to have been shot down by Zero-sen pilots from *Shokaku* on this date, although only two Dauntlesses actually fell to IJNAF fighters. (NARA)

A6M1

The two prototype 12-shi fighters powered by the 875hp Mitsubishi Zuisei engine were redesignated A6M1s. The aircraft's fuselage was built in two sections, with the engine and cockpit attached to the wing structure – the top of the wing actually served as the cockpit floor. This saved a great deal of weight, but made construction more time consuming. Battle damage and maintenance also proved problematic. Major damage to a wing required a complete replacement. The forward fuselage section ended at the back of the cockpit canopy and the trailing edge of the wing. Like the SBD, the Zero-sen was built using stressed skin, semi-monocoque construction. Ailerons, rudder, and elevator controls were fabric

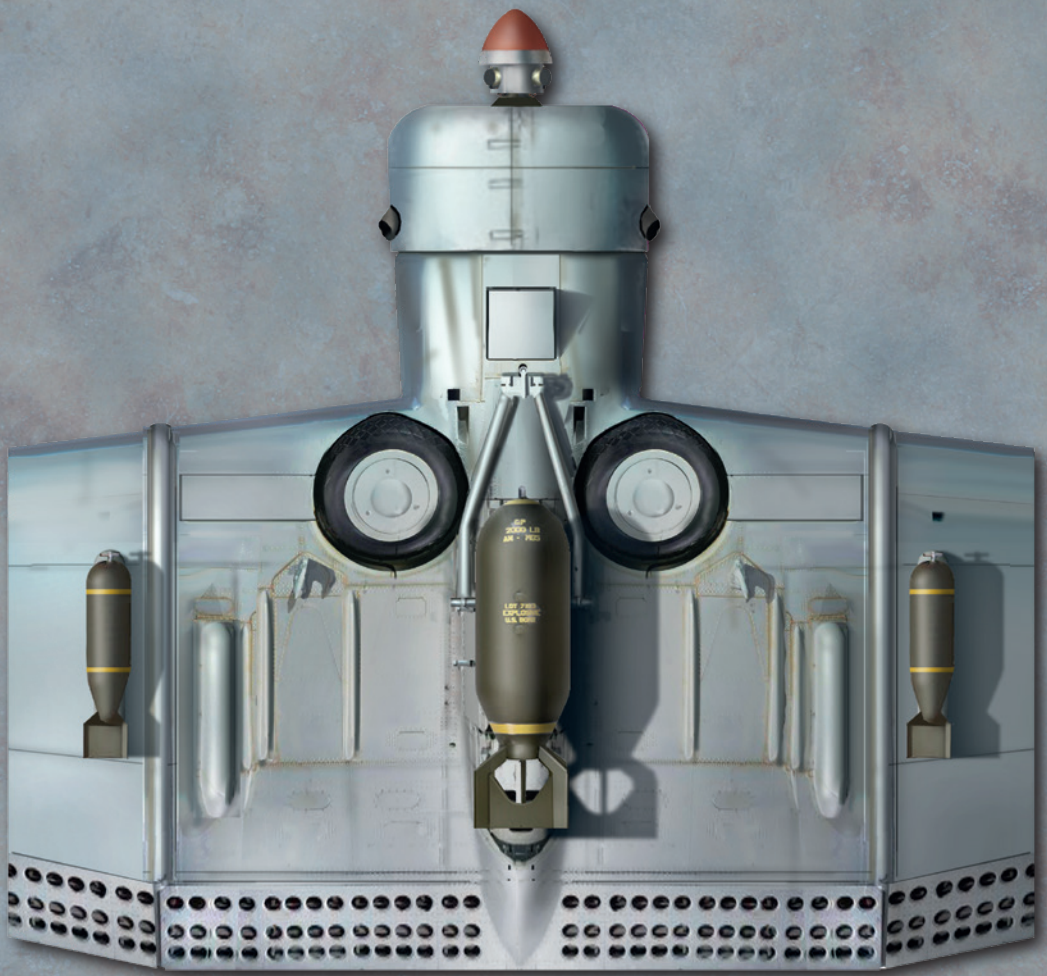


covered. Internal fuel consisted of two non-self-sealing 51.5-gallon wing tanks and one 38-gallon tank in front of the cockpit. The main landing gear, tail wheel, and arrestor hook were all fully retractable.

Armament consisted of two Type 97 7.7mm machine guns and two Type 99-1 20mm cannon. The latter was a license-built version of the Swiss Oerlikon FF weapon. In a trade-off for light weight, the Type 99 had both a low rate-of-fire (540 rounds per minute) and low muzzle velocity. Against slower bombers and long-range patrol aircraft, the 20mm cannon was a good weapon, but in fighter-versus-fighter combat, it was a liability. In his memoir *Samurai!*, ace Saburo Sakai commented, "Our 20mm cannon were big, heavy, and slow-firing. It was extremely hard to hit a moving target [with the weapon]. Shooting down an enemy aircraft was like hitting a dragon fly with a rifle! It was never easy to score – our opponents made it very tough." A selector on

SBD DAUNTLESS BOMBLOAD

The full loadout for the SBD comprised one AN-M65A1 1,000lb General Purpose bomb on the centerline and two AN-M57A1 250lb General Purpose bombs under the wings. The 1,000lb bomb's metal components weighed 435lb, leaving a high explosive charge of 530lb. The 1,000lb GP bombs proved extremely effective against IJN aircraft carriers, while the 250lb bombs provided added destruction by detonating above deck structures in order to help suppress anti-aircraft defenses.



the throttle gave the pilot the option of firing the machine guns or the cannon separately, or all four together.

A6M2 MODEL 11

The third and fourth A6M prototypes were powered by the 950hp Nakajima Sakae 12 engine, featuring a two-speed supercharger, which gave the aircraft a maximum speed of 331mph. Several minor modifications included moving the vertical tail aft by 11 inches, increasing the span of the horizontal tail surfaces by four inches and raising it 7.4 inches above the fuselage centerline. The air scoop for the Sakae engine's carburetor was relocated to the bottom of the engine cowling – a distinctive feature of the A6M2.

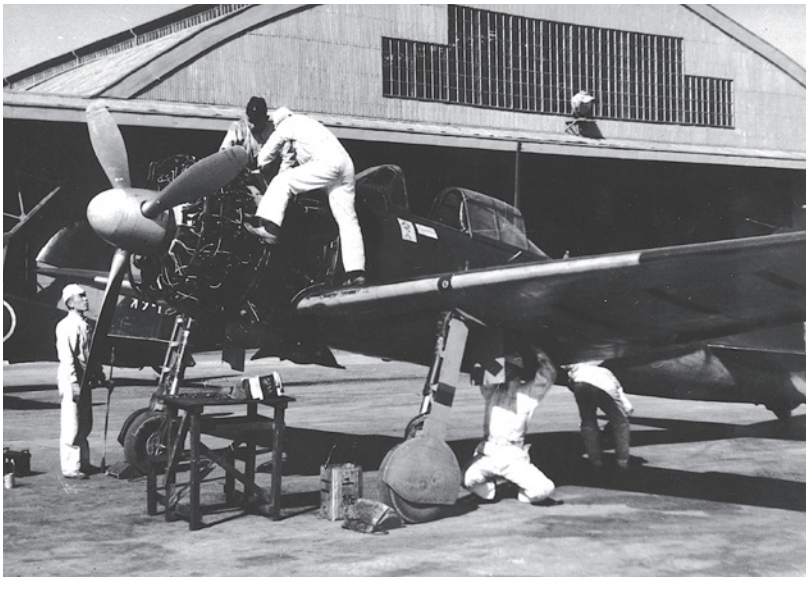
After the IJNAF's formal acceptance of the A6M2, the new fighter became the Type 0 Carrier Fighter Model 11, shortened to Reisen (Zero-sen Fighter). The first digit in the model number indicated changes in the airframe and the second digit changes in the engine. Mitsubishi built 64 Model 11 fighters.

The Model 11 was the first version to see combat when 15 aircraft were sent to 12th Rengo Kokutai at Hankow, in China, for operational testing.

A6M2 MODEL 21

Carrier trials apparently indicated that even though the Zero-sen was within the specified wingspan, the fighter was a tight fit on a standard aircraft carrier elevator. To remove the chance of accidental damage to the wings, Mitsubishi designed a simple mechanism to fold the outer 20 inches of the wing vertically, reducing the wingspan to just under 36ft. The IJNAF rejected the idea of incorporating a greater degree of wing folding due to the weight penalty it would have imposed. The modified wing configuration led to a change in model number, the revised aircraft becoming the Model 21. The Model 21 replaced the A5M within IJNAF carrier- and land-based air groups as production at Mitsubishi and Nakajima built up. Ironically, the Nakajima Company would ultimately build more Zero-sens than Mitsubishi.

A significant difference between the carrier- and land-based versions of the Model 21 was the provision of a radio. The quality of Japanese airborne radio technology at the beginning of the Pacific War was barely adequate for air-to-air and air-to-ground communications, with the Type 96 Air Mk I Radio Telephone lacking both clarity in communication and range because of interference from the

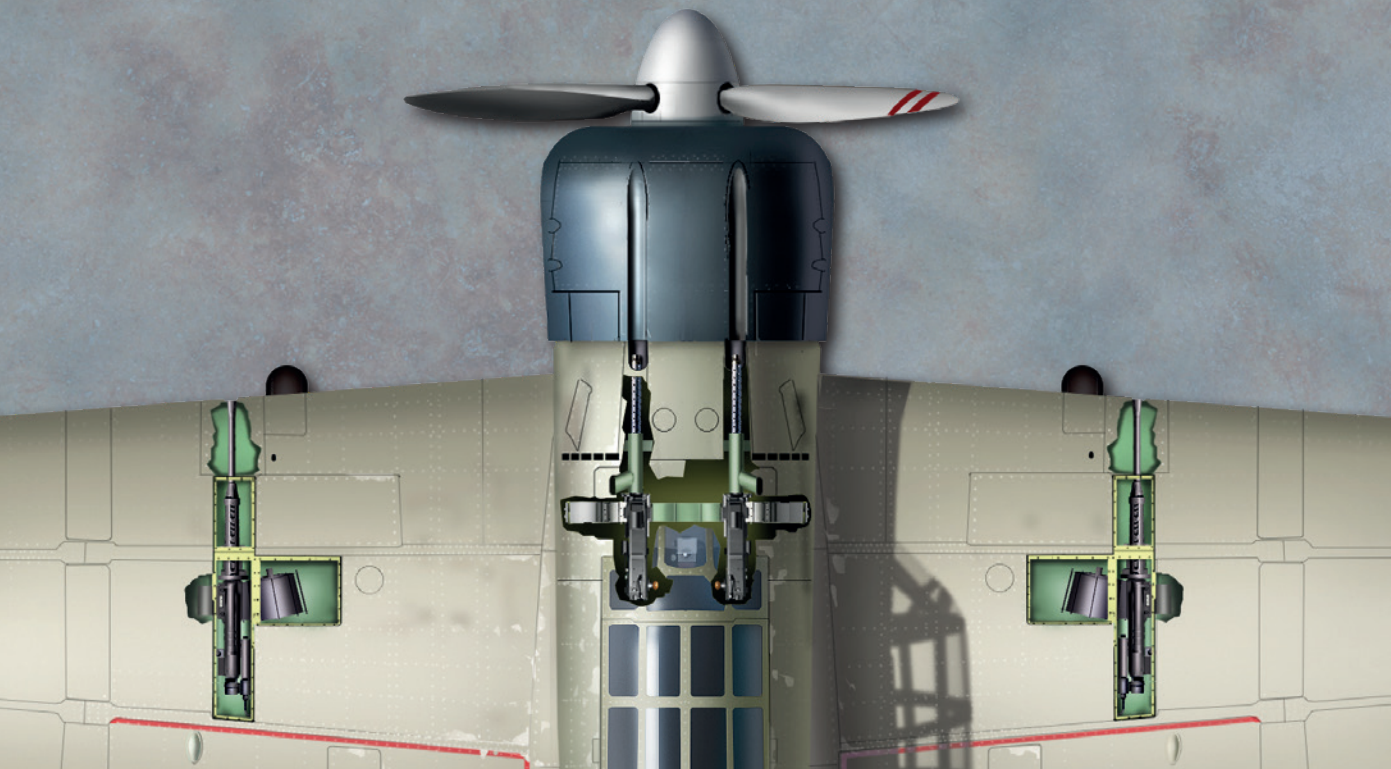


An A6M2 Model 21 of Oita Kokutai receives routine maintenance at Oita airfield, on Kyushu. This unit was tasked with training both Zero-sen pilots and groundcrew destined for the frontline. (NARA)

engine ignition and static caused by improper grounding to the fuselage. When the radio did work, it had a range of about 50 miles. Unfortunately, the ability of groundcrews to service them properly resulted in the Type 96 being a failure. For a carrier fighter, a radio was clearly a necessity, even if of poor quality, but some land-based Zero-sen units removed them, viewing the equipment as so much useless

A6M2 ZERO-SEN MODEL 21 COWLING/WING GUNS

While the A6M2 was considered to be heavily armed, its two wing-mounted 20mm cannon had some major drawbacks. The Type 99-1 weapon was based on the Oerlikon FF cannon, which was exceptionally light. Its low rate-of-fire and low muzzle velocity, however, meant Zero-sen pilots had to fire well within range of SBD rear gunners in order to score any hits. With just 60 rounds per gun, the cannon in the Model 21 had only ten seconds worth of firing and a rate of fire of just 540 rounds per minute. Secondary armament consisted of two Type 97 7.7mm machine guns mounted on top of the forward fuselage. Each weapon carried 500 rounds per gun, and their rate of fire was an impressive 900 rounds per minute. Zero-sen pilots soon discovered their mixed armament was not as effective against carrier aircraft as they had hoped. By themselves, the two 7.7mm guns were rarely capable of bringing down a rugged US Navy aircraft, and it took a great deal of skill and marksmanship to score hits with the cannon. With such a limited number of 20mm rounds, IJNAF pilots could not afford to waste any. Because of the cannons' low muzzle velocity, their effective range was just over 200 yards. Shooting down SBDs proved a daunting task, as Zero-sen pilots rarely surprised their crews. The dive-bomber's ability to maneuver defensively and shoot back at its attacker meant A6M pilots never had an easy kill. All A6M2s were fitted with the IJNAF Type 98 reflector gunsight. Based on the German Revi 2b, it featured an illuminated circular reticule and was developed to replace the previous telescopic sight. The Zero-sen pilot could fire the machine guns and cannons separately or both at the same time using a selector switch on the throttle control. Like SBD pilots, Zero-sen pilots were also plagued by the problem of condensation in the cockpit. During dives to low level, the high tropical humidity caused the windscreen to fog over. IJNAF pilots solved the problem by simply sliding the canopy back before diving, thus equalizing the humidity in the cockpit.



weight. Nakajima began manufacturing the Zero-sen in November 1941, and along with Mitsubishi produced 740 of the type.

A6M3 MODEL 32

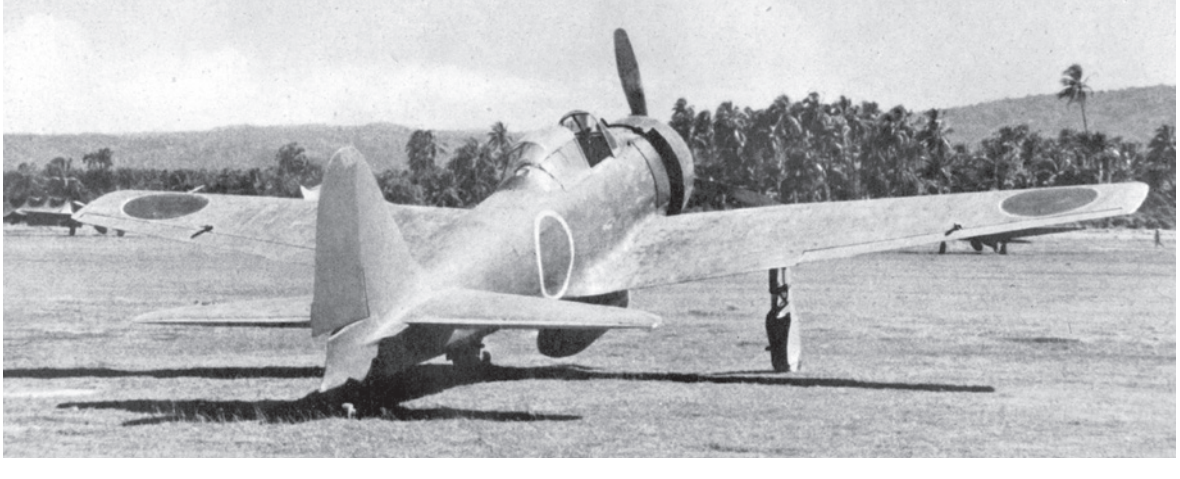
To improve the Zero-sen's altitude and climb performance, the 1,130hp Nakajima NK1F Sakae 21, which featured a single stage, two-speed supercharger, was installed. Although more powerful than the NK1C Sakae 12 fitted to the A6M2, the new engine added an extra 280lb to the weight of the airframe. Fuel capacity was also reduced by 21 gallons due to the increase in the dimensional size of the engine, adversely affecting the fighter's combat radius. It was also found that the Sakae 21's fuel consumption was considerably higher than the Sakae 12's when both were run at full power.

Even with the new engine and supercharger, the performance gains achieved with the A6M3 were negligible. Test pilots evaluating the new model suggested removing its folding wingtips. The new squared wing raised the maximum speed slightly, and also improved aileron control, roll rates and the aircraft's performance in a dive. Ammunition for the 20mm cannon was also changed from a drum magazine to a belt-feed system, increasing the number of rounds from 60 to 100 per gun.

Initial flight trials of the A6M3 began in June 1941, and the first unit to see combat with the new Model 32 was Rabaul-based 2nd Kokutai in the spring of 1942. With its lack of range preventing the A6M3 from undertaking long-range bomber escort missions to distant targets over Guadalcanal, the Model 32 was restricted to flying defensive patrols closer to Rabaul. Shortly after the aircraft had first been encountered by the Allies in combat in October 1942, it was given the code name "Hamp," which was later changed to "Zeke 32." The A6M3 was not a success, and just 343 were delivered to the IJNAF.

A6M3 MODEL 22

This aircraft actually preceded the Model 32, but in order to meet the demand for the squared-winged version, it was initially set aside. Combat experience with the Model



The A6M3 Model 32, which entered service during 1942, attempted to address the need for better performance at altitude and control at high speed. Note its clipped wingtips – the most visible distinguishing feature of the variant. This 204th Kokutai aircraft, based at Buin on Bougainville Island in early 1943, wore the code "T2-190" on its tail, although the serial was removed by the Japanese censor before the photograph was released to the press. (Tony Holmes Collection)

32 led to an urgent request to restore the Zero-sen's range. The Sakae 21 engine was retained, and fuel was increased by 24 US gallons. This gave the Model 22 the greatest range of all the Zero-sen models, with the aircraft capable of covering 1,930 miles with a drop tank. The majority of the 560 examples built retained the same armament as the Model 21, although some late-production aircraft were fitted with the more powerful Type 99-2 20mm cannon.

A6M5 MODEL 52

Built in greater numbers (1,701) than any other Zero-sen variant, the A6M5 Model 52 was an attempt to upgrade the aircraft's performance in the face of increasing numbers of second-generation American fighters, while simplifying production. The Model 52 retained the basic fuselage structure of the earlier models, but featured a shorter-span, re-designed wing with rounded wingtips. The folding wing mechanism was removed completely and the ailerons faired into the outboard wingtip. Mitsubishi increased the thickness of the wing skinning to allow an increase in the diving speed to 410mph.

Four fuel tanks in the wings, the main tank next to the fuselage, and a smaller tank outboard helped retain the Zero-sen's long range with the shorter wing. After the 371st production aircraft, Mitsubishi installed a CO_2 fire-extinguishing system to protect the fuel tanks in the wings, with CO_2 tanks located behind the cockpit.

The Model 52 used the Nakajima Sakae 21 engine, but with individual exhaust stacks, producing a higher maximum speed of 351mph. Armament remained the same as in late Model 22 aircraft, consisting of two 7.7mm Type 97 machine guns in the nose and two Type 99-2 20mm cannon in the wings, firing a more powerful projectile with increased muzzle velocity. The A6M5 Model 52 went into production at Mitsubishi in August 1943, while Nakajima began building Model 52s from February 1944.

A6M5 MODEL 52a

Roman letters a, b, and c were used to identify subsequent models of the A6M5 – SBDs only encountered Model 52a/bs. The Model 52 entered combat just as the US Navy introduced the F6F-3 Hellcat, resulting in IJNAF units soon calling for even better performance from the Zero-sen. There was little the already over-stretched Mitsubishi design team could do in the way of introducing substantive improvements, however, and the IJNAF, desperate for more fighters, was reluctant to disrupt production. The Model 52a was a stopgap, with only minor modifications. The thickness of the wing skinning was increased to

Several dozen A6M5 Zero-sens were found in various states of disrepair at Aslito Field, on Saipan, following the base's seizure by the US Army's 27th Infantry Division on June 18, 1944. Most of the aircraft, including this example, belonged to 261st Kokutai, and no fewer than 12 A6M5s from the unit were shipped back to the US on board the escort carrier USS *Copahee* (CVE-12) shortly after they had been captured. Restored to airworthiness, the Nakajima-built Model 52 performed a dedicated aerial recognition photo-flight from Bakersfield Municipal Airport, California, in April 1945 while assigned to the 412th Fighter Group for air combat training with the unit's P-59 Airacomet and P-80 Shooting Star jet fighters. (NARA)

allow an even higher diving speed, while the ammunition feed for the two Type 99-2 20mm wing cannon was switched from a 100-round drum to a belt-fed system containing 125 rounds per weapon. The latter was redesignated the Type 99-2 Model 4 cannon. The first production aircraft left the factory in March 1944.

A6M5 MODEL 52b

The Model 52b was another hurried attempt to improve the Zero-sen without major modifications. For the first time, the IJNAF approved a change in armament. In developing the Zero-sen, the IJNAF had jumped from the 7.7mm machine gun directly to the 20mm cannon, skipping the intermediate heavier machine gun class in favor of the more powerful cannon intended for destroying bombers. In high-speed fighter-versus-fighter combat, the slower-firing 20mm cannon was not as effective.

In the Model 52b, which went into production in April 1944, the IJNAF removed one of the nose-mounted 7.7mm Type 97 machine guns and replaced it with a single 13.2 mm Type 3 machine gun – a development of the Browning 0.50-cal. machine gun with a rate of fire of 800 rounds per minute, compared to 490 rounds per minute for the 20mm Type 99-2 cannon. For protection against frontal attacks, Mitsubishi added a two-inch thick armored windscreen built from two layers of plastic sandwiched between two sheets of glass.

SBD-3 Dauntless and A6M2 Model 21 Comparison Specifications

	SBD-3 Dauntless	A6M2 Model 21
Powerplant	1,000hp Wright R-1820-52	950hp Nakajima Sakae 21
Dimensions		
Span	41ft 6in.	39ft 4.7in.
Length	32ft 8in.	28ft 8in.
Height	13ft 7in.	10ft 0in.
Wing Area	325 sq. ft.	241.5 sq ft.
Weights		
Empty	6,345lb	3,740lb
Loaded	10,213lb	5,313lb
Performance		
Max Speed	250mph at 10,000ft	331mph at 14,930ft
Range	1,580 miles (scout) and 1,345 miles (dive-bomber)	1,160 miles (internal fuel only) and 1,930 miles (with drop tank)
Climb	to 10,000ft in 8 min 30 sec	to 19,685ft in 7 min 27 sec
Service Ceiling	27,100ft.	32,810ft.
Armament	two fixed 0.50-cal. Browning M2 machine guns and two swivel-mounted 0.30-cal. AN/M2 machine guns	two 7.7mm Type 97 machine guns in upper fuselage decking and two Type 99-1 cannon in wings

THE STRATEGIC SITUATION

Saratoga's air group "turns up" during peacetime operations in the fall of 1941. VF-3's F4F-3s are spotted first for a deck-run takeoff, followed by the SBD-2/3s of VB-3, VT-3's TBD-1s, and VS-3's SBD-2/3s. All aircraft are painted light gray overall, with the national insignia containing the red ball in four positions – upper port and lower starboard wings, plus on either side of the fuselage. (NHHC)

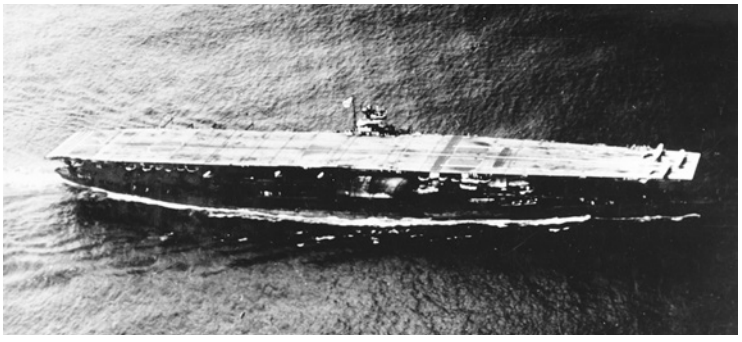
"Carriers are like two blindfolded men armed with daggers in a ring – there is apt to be sudden destruction to one or both."
Rear Adm Henry V. Butler, Commander-in-Chief, Aircraft Squadrons, Battle Force, US Navy

In February 1940, the US Navy transferred the Pacific Fleet from San Diego to Pearl Harbor. For Japanese military strategists, this was seen as a direct threat and a major obstacle to the nation's planned expansion in Asia and the Pacific.

Japan's strategy in World War II called for the capture of Western-controlled resources in Southeast Asia, followed by the establishment of a defensive perimeter stretching from the Aleutian Islands, through the Central Pacific, the Solomon and Bismarck Islands, New Guinea, the Netherland East Indies, and west to the Burmese border with India. All the areas earmarked for occupation were captured either on schedule or earlier, except for the Philippines.

With a large surface fleet (nine aircraft carriers and ten battleships) and a newly acquired string of airfields and anchorages, the Japanese planned for a coordinated defensive battle against the US

Navy. As American naval forces headed west, IJN submarines and IJNAF flying boats would be tasked with picking off US Navy warships in a slow battle of attrition. Having weakened the Pacific Fleet, the IJN's Combined Fleet would then destroy it in one decisive battle, forcing the Americans to settle for a political peace.



Akagi served as flagship of First Kido Butai from its formation in early 1941 until the carrier was scuttled on June 5, 1942 after it had been attacked by three SBDs from VB-6 the previous day during the Battle of Midway. Three Zero-sens can be seen ranged over the bow of the vessel in this photograph, taken in the summer of 1941. *Akagi*'s air group typically numbered 54 aircraft during the first six months of the Pacific War. Eighteen of these machines were A6M2s, nine of which were usually assigned fleet defense when the carrier was at sea –three airborne, three ready for immediate launch, and three in a lesser state of readiness. (NHHC)

US strategy for the coming conflict with Japan was equally as well thought out, with tactics having been refined and revised in the decades leading up to the beginning of the war in the Pacific. With remarkable prescience, the US military produced War Plan Orange. The crucial thrust of the plan centered on a maritime war against Japan in three phases. In Phase I, the Americans predicted the Japanese would seize US possessions in the Pacific, including the Philippines and territory in Southeast Asia. Phase II would be the American response, with a naval offensive to capture islands in the Carolines, Marshalls, and Gilberts. With secure bases and supply lines, the recapture of the Philippines would be possible. Phase III would target islands closer to Japan. This would tighten the blockade around the Home Islands and provide bases for the all-out aerial bombing campaign against Japan.

Well before the attack on Pearl Harbor, the US Navy had plans for a new and powerful fleet of aircraft carriers as part of the implementation of the Naval Expansion Act of May 1938. The first three vessels of the Essex-class were ordered in July 1940, with ten more following eight weeks later as part of the Two-Ocean Navy Act. A total of 24 such carriers would be built between 1941 and 1950.

The Japanese knew that a short, victorious war was their only hope, while the American plan envisioned a step-by-step campaign that would take years not months. An attack on Pearl Harbor was seen as equally likely by both sides. In 1941, as tensions grew between the two nations, the Americans became increasingly aware that an attack by the Japanese in the Pacific was coming – they just did not know where.

During the late 1930s, the IJN recognized the need to concentrate its carrier power by using two such vessels in a single formation. This important advantage would give the Japanese greater striking power and tactical initiative. In April 1941, the IJN organized all of its fleet carriers into a single formation, which it designated First Air Fleet. The operational component of First Air Fleet was the Kido Butai (Mobile Force). Kido Butai was made up of three carrier divisions – First with *Akagi* and *Kaga*, Second with *Soryu* and *Hiryu*, and Fifth with *Shokaku* and *Zuikaku.* Kido Butai conducted operations as a multicarrier formation.

On December 6, 1941, Kido Butai's six fleet carriers neared their launch points for the surprise attack on Pearl Harbor. From a position 200 miles north of Oahu, the carriers turned into the wind and began launching their aircraft. At 0751 hrs on December 7, 1941, 183 aircraft (49 B5N high-level bombers, 51 D3A dive-bombers, 43 A6M fighters, and 40 B5N torpedo-bombers) of the first wave began their attacks. Surprise was devastating and complete. This was followed by a second wave at 0900 hrs of 40 (A6M) fighters, 54 (B5N) high-level bombers, and 80 (D3A) dive-bombers.

Limit of Japanese control
Supply lines to Australia
USSR
MONGOLIA
Nomonhan
MANCHURIA
Peking
KOREA
Seoul
JAPAN
Tokyo
Kamchatka
ALEUTIAN ISLANDS
KURILE ISLANDS
PACIFIC OCEAN
AFGHANISTAN
CHINA
Nanking
Shanghai
Chunking
NEPAL
INDIA
Calcutta
BURMA
Hanoi
Hong Kong
Formosa
RYUKYU ISLANDS
Okinawa
BONIN ISLANDS
Iwo Jima
Marcus Island
Midway Island
Battle of Midway, June 4–7, 1942
Bombay
Rangoon
THAILAND
Bangkok
FRENCH INDOCHINA
Saigon
Madras
Trincomalee
Colombo
CEYLON
Luzon
Manila
First Battle of the Philippine Sea, June 19–20, 1944
MARIANA ISLANDS
Saipan
Guam
Pearl Harbor
Attack on Pearl Harbor, December 7, 1941
HAWAIIAN ISLANDS
Johnston
Mindanao
CAROLINE ISLANDS
Truk
MALAYA
Singapore
Palmyra
Christmas Island
New Ireland
BORNEO
Celebes
SUMATRA
NEW GUINEA
Rabaul
Battle of the Eastern Solomons, August 24–25, 1942
New Britain
SOLOMON ISLANDS
Batavia
Bali
Java
Timor
Port Moresby
Battle of the Santa Cruz Islands, October 26, 1942
Tulagi
Guadalcanal
Darwin
INDIAN OCEAN
Battle of the Coral Sea, May 4–8, 1942
NEW HEBRIDES
SAMOA ISLANDS
SOCIETY ISLANDS
FIJI ISLANDS
COOK ISLANDS
AUSTRALIA
Brisbane
Perth
Sydney
N
0
1,000 miles
0
1,000km

The primary targets of the attack were the three carriers of the Pacific Fleet. The IJNAF would be disappointed, however, for *Enterprise* was steaming back from Wake Island, *Lexington* was cruising close to Midway Island, and *Saratoga* was in San Diego. While the carriers had been saved, the damage inflicted on the Pacific Fleet was devastating. Five battleships, one mine layer, three destroyers, two service craft and an auxiliary had been sunk, one cruiser and one auxiliary severely damaged and three battleships, two cruisers, and one destroyer moderately damaged. No fewer than 188 aircraft had also been destroyed and 159 damaged. As the Japanese retired, Kido Butai had clearly established the supremacy of carrier air power, making it the most formidable striking force in the Pacific.

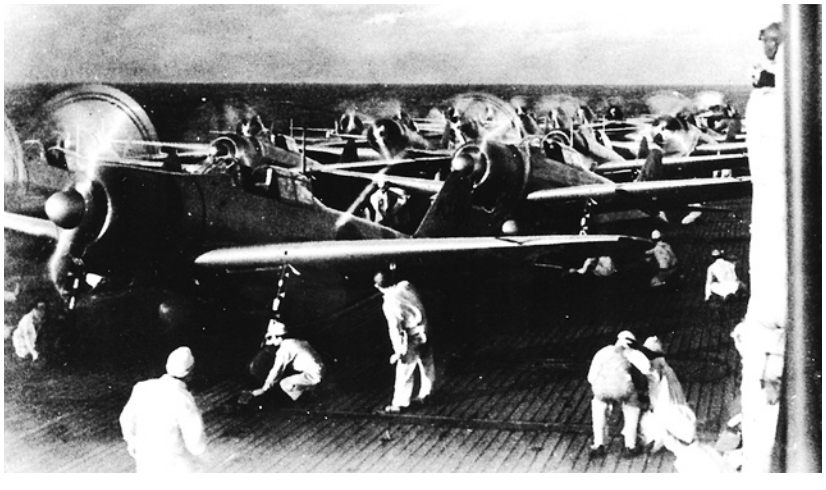
In a single stroke the US Navy carrier-air doctrine for the defense of the battle line had been altered forever. With the bulk of the battleship force lying on the bottom of Pearl Harbor, but with the carriers unscathed, the Naval Aviators now had a chance to implement what they had been arguing for, for so long – task force strike operations built around the fast carrier and its full complement of torpedo- and dive-bombers.

Japan's carrier force had achieved a great, but limited, victory. Its leaders went to war knowing what the nation's immediate objectives would be, and how to achieve them, but they were in many ways willfully ignorant and naïve about what would follow after the initial months of success. As early as the afternoon of December 8, 1941, US Navy war plans were quickly amended and issued to the remnants of the Pacific Fleet at Pearl Harbor and the carriers at sea. American strategy in the Pacific now switched tack, and it "depended on two cardinal points" – Hawaii and Australia. First priority was to secure the sea lanes between Midway, Hawaii and the west coast of America. Second priority was the protection of the sea lanes between America and Australia. The newly appointed Chief of Naval Operations, Adm Ernest J. King, referred to them as those "two vital Pacific tasks."

Japan had no plans to invade Australia in 1942, the nation's strategy instead being focused entirely on holding onto its newly won "Greater East-Asia Co-Prosperity Sphere." With America fully committed to war, men and supplies began building up in Hawaii and Australia. It would only be a matter of time before the Allies would launch attacks in the Central and South Pacific. The Japanese Imperial General Headquarters was now forced to amend its plans and divert forces to both destroy remaining American sea power in a decisive battle and prevent Australia from becoming a base for offensive operations. To achieve that second goal, it proposed isolating Australia "through air and naval action" and the securing of key islands and ports in New Guinea, the southern Solomons, Fiji,

OPPOSITE

Of the six major carrier operations of the war, half were conducted in the Coral Sea and in the waters surrounding Guadalcanal. Even with the decisive victory at Midway, the IJN still had a potent carrier force resulting in the battles of the Eastern Solomons and the Santa Cruz Islands. The presence of US Marine Corps and US Navy SBDs ashore on Guadalcanal and embarked in the remaining Pacific Fleet carriers was a definite factor in the US victory on Guadalcanal in 1942–43.



Nine A6M2 Zero-sens, their engines idling, prepare to take off en masse from *Akagi* as part of the second wave attack on Pearl Harbor on December 7, 1941. An identical number of fighters had departed the carrier for the first wave strike, their task being to escort 15 B5N2s targeting Battleship Row. The second wave Zero-sens escorted 18 D3A1s that attacked both Pearl Harbor and nearby airfields, with the fighter pilots also strafing Hickam Field three times. (Tony Holmes Collection)

SBD-3 crews of VB-6 prepare for take-off from the flightdeck of *Enterprise* at the start of the Wake Island raid on February 24, 1942. Air group commander Lt Cdr Howard Young is in the second Dauntless, as denoted by the letters *GC* (for Group Commander) on either side of the engine cowling. The airfield on Wake was bombed and two flying boats sunk in the nearby lagoon, although one SBD (from VS-6) was lost to anti-aircraft fire over the island. (NHHC)

Samoa, and New Caledonia. The IJN's objective was to draw the US Navy into a major battle, defeat it decisively and hopefully encourage Australia to sue for peace.

The key to the successful implementation of the Japanese plan to isolate Australia was the capture of Port Moresby on the south coast of New Guinea. Whilst it remained in Allied hands, the major IJN fortress at Rabaul would come under threat of air attack. With the seizing of Port Moresby, Japanese aircraft could "strike at will at the north coast" of Australia and adjacent sea lanes.

On March 8 the Japanese mounted their first operation toward the occupation of Port Moresby by seizing Lae and Salamaua on the east coast of New Guinea. It did not go according to plan. Prior to the invasion, US Navy carriers mounted a series of hit and run raids on Japanese bases in February and March. These attacks targeted airfields and ports in the Marshall and Gilbert Islands and Wake Island. The strikes were designed to give US Navy aircrews a chance to "blow the tape off their guns," drop bombs and experience combat for the first time. No Zero-sens were encountered during these operations.

On March 10, the US Navy launched its first multi-carrier raid of the war. *Lexington* and *Yorktown* each sortied 52 aircraft to attack IJN vessels off Lae and Salamaua. It was here the SBD started to make its presence felt, and thus help alter the trajectory of the Pacific War. Although taking the Japanese completely by surprise, and encountering minimal anti-aircraft defenses and no IJNAF fighters, the aircraft managed to sink just four transport vessels and damage a light cruiser and two destroyers. The raid was considered a failure. The unreliability of the Mk XIII torpedoes dropped by TBD Devastators was a major contributing factor, and if it had not been for the bombs of the SBDs no ships would have been sunk.

Even with the poor results the raid proved a critical action, as the Imperial General Headquarters now realized that the planned assault on Port Moresby would require the support of aircraft carriers. The IJN was now forced to react to American actions and enter into operations it had not planned for.

Two months later, the IJN's Striking Force, consisting of the fleet carriers *Shokaku* and *Zuikaku* and the light carrier *Shoho*, set sail from Rabaul to attack Port Moresby. US Navy code breakers were aware of the operation, and TF 17 (centered on the carriers *Lexington* and *Yorktown*) was despatched to engage the Japanese vessels in what would be known as the Battle of the Coral Sea – the first naval battle in history where opposing ships never sighted each other. For the first time since the Pearl Harbor raid, SBDs and Zero-sens would clash in aerial combat.

THE COMBATANTS

"When we began in August 1942, most of our pilots were very well trained, with more than 500 hours flying time. But by January 1, 1943, only about 15 percent were left, and we were receiving pilots fresh from school. They only had about 100 flying hours in combat aircraft, maybe 200 overall."
IJN Fleet staff officer Toshikazu Ohmae

US NAVY AND US MARINE CORPS PILOT AND RADIOMAN/GUNNER TRAINING

At the outbreak of the Pacific War, the US Navy was the most prepared of the two services. The USAAC was not only numerically second-rate, it was profoundly short of equipment and sound doctrine. In contrast, the US Navy possessed a great fleet, solid doctrine, well trained aircrew and aircraft designed for very specific roles – fighter, torpedo-bomber, and dive-bomber. In April 1935, Congress had passed the Naval Aviation Cadet Act authorizing the US Navy to recruit flight officers (later ensigns) from US colleges for service in the volunteer naval reserve. By the time Pearl Harbor was attacked almost seven years later, up to half the aircrew in the US Navy were reservists.

In April 1939 Congress passed the Naval Aviation Reserve Act, which allowed the US Navy to further expand its recruitment of aircrew. Following the outbreak of war in Europe five months later, Congress also ordered more warships and aircraft. This was followed on July 20, 1940 by the Two-Ocean Navy appropriations bill, authorizing $4 billion for the acquisition of 18 carriers and 15,000 new aircraft by 1946.

A sailor cranks up the engine of a N3N-1 at the start of a training flight for a Naval Aviation cadet, circa 1940–42. Nicknamed the "Yellow Peril," the Naval Aircraft Factory N3N served as the primary trainer for the US Navy and US Marine Corps from 1936. It shared this role with the more common Stearman NS/N2S, the first examples of which entered service with the US Navy in 1935. (NHHC)

While both services suffered from a severe shortage of modern fighting aircraft at the start of the Pacific War, the US Navy was in a better state of preparation when it came to taking the fight to the enemy. Instead of rushing to acquire obsolete aircraft in order to up its numerical strength, the US Navy allocated its resources to training while waiting for the delivery of the more modern monoplane types. After the fall of France in late June 1940, Congress quickly authorized an increase in US Navy aircrew training from 4,500 per year in 1941 and 6,000 in 1942 to an incredible 15,000 in 1943 – far outstripping anything the IJNAF had planned. Training time was also shortened, from one year to seven months for pilots and under six months for radioman/gunners. These expansion plans were ambitious, and by 1941 they were still just ramping up.

In 1942, the battles between the SBD Dauntless and the Zero-sen pitted the very best of the IJNAF against the US Navy's pre-war aviators and their US Marine Corps counterparts. All three air arms had men of considerable flying experience, but the Japanese had many pilots who had seen combat in China. Carrier training was rigorous, requiring a set of skills not found in regular air force pilots. US Navy pilots and radioman-gunners had to be better than their land-based counterparts. Not only did they have to master the skills of taking off and landing on a rolling carrier deck, they also had to navigate over vast distances, identify enemy vessels, be highly proficient in morse code, attack with precision, and then return and land after countless hours in the cockpit. It was a test of endurance and skill.

Due to the relatively small number of pre-war aircraft and pilots authorized to fly for the US Navy and US Marine Corps, flight training focused on giving Naval Aviators instruction in how to fly *all* types from floatplanes to patrol aircraft. The process began with 33 weeks of ground school, followed by a year where trainees worked their way through the five training squadrons at Pensacola, Florida. In Squadron One, students flew primary seaplanes (float-equipped N3N biplane trainers). After nine weeks, having learned basic flying procedures, they progressed to Squadron Two. This consisted of flying primary land trainers for 18 weeks. With aerobatics, night flying, formation flying, and cross-country navigation all mastered, students would be introduced to more powerful second-line operational aircraft liked the Vought O3U and SBU biplanes in Squadron Three. Here, the student would develop the skills he mastered in Squadron Two, and also take on instrument flying for the first time. In Squadron Four, nine weeks were committed to flying operational seaplanes and flying boats. Squadron Five gave the trainee his first experience at the controls of operational carrier aircraft, and included instruction in aerial gunnery, combat tactics, dive- and torpedo-bombing, and carrier take-offs and landings.

After a full year, and having accumulated close to 300 hours flying in numerous types, the Naval Aviator would earn his highly coveted wings of gold. Shortly thereafter, the newly minted pilot would be assigned to a carrier air group or

land-based squadron. Although would-be dive-bomber pilots had completed their training in Squadron Five, the 85 hours spent in the air with this unit did not qualify them as carrier pilots. This was left to the individual fleet squadrons, which conducted carrier qualifications on a regular basis whenever they went to sea.

Pilots and radioman-gunners also participated in routine gunnery exercises. The most basic was Individual Battle Practice (IBP), which saw individual crews shooting at ground targets, remote-controlled ships, and target sleeves towed by other aircraft. Formation Battle Practice (FBP) was more advanced, and included practice flying in sections. FBP was used to test and perfect battle tactics, which was where the training between the VS (Scout) and VB (Bombing) squadrons diverged. Pre-war VS pilots practiced air-to-air gunnery, along with the standard dive-bombing and scouting mission. VB pilots concentrated exclusively on dive-bombing. Official gunnery exercises where held once a year, giving dive-bomber pilots and radioman-gunners a chance to practice and perfect their aerial gunnery. These exercises varied depending on the weapons employed, and whether live ammunition, practice bombs, or gun cameras were utilized.

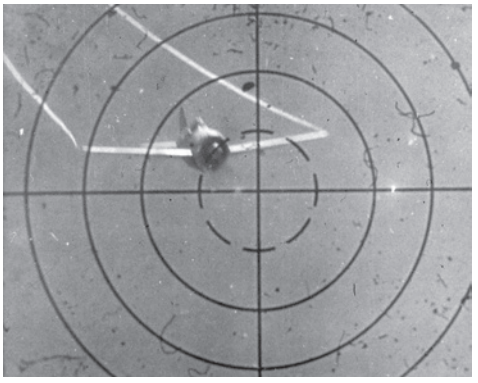
Lt David R. Berry was typical of the many combat-seasoned Naval Aviators who returned to the US after completing their frontline tours and became instructors. He was photographed with a brand new SBD-5 at NAS Jacksonville, Florida, in 1943, Berry instructing here from October 1942 through to September 1944. What set him apart from many of his peers was the fact that he had received the Navy Cross three times with VS-5 following his actions in an attack on Tulagi harbor on May 4, 1942, during the Battle of the Coral Sea four days later and in the Battle of Midway on June 4. He was subsequently killed in action leading SB2C-equipped VB-83 from *Essex* on May 13, 1945. (NHHC)

Because the dive-bomber was considered to be the carrier's primary strike weapon, dive-bombing exercises were conducted on a regular basis against fixed targets. At least once a year, the squadrons also tested their skills against a moving target. Competition between units was keen, with the coveted mark of "E" for excellence being awarded to the best unit.

VS and VB squadrons also simulated mock combat between dive-bombers and intercepting fighters. In one exercise performed in October 1940, the BT-1s of VB-6 were pitted against four F3F-2 biplane fighters from VF-6 – the latter were equipped with gun cameras to assess the score. The results showed how difficult it was for fighters to disrupt, let alone stop, a dive-bombing strike, especially once the attacking force had pushed over. The bomb score achieved by VB-6 was an impressive 31 percent while under fighter attack; a tally that is remarkably consistent with the number of bomb hits achieved by the more experienced SBD pilots during the Battle of Midway.

BACKSEATERS

When the Pacific War commenced, the US Navy and US Marines Corps were still transitioning from biplanes to more modern monoplane types. Because of this, pre-war aircrew training faced a number of obstacles, with technician-gunners being particularly affected. As in World War I, priority on all new operational equipment and aircraft was given to the fleet. Training programs and schools were forced to use obsolete equipment, despite the fact this meant training men in radio communications and, in some cases, armaments no longer found in the fleet. This left them both ill-equipped and



A still image of what a gun camera kill would look like. This image captures an F2A Buffalo in the cross-hairs during air-to-air gunnery training. Note the wingtip vapor trails, which were sometimes mistaken for smoke during aerial combat in the humid air in the South Pacific. This resulted in pilots and gunners claiming a victory when in fact no kill had been made. (NARA)

A US Navy radioman-gunner poses with a standard 0.30-cal. AN/M2 aircraft machine gun. This weapon equipped the SBD-1, -2, and early -3s. Its rate of fire was 1,200 rounds per minute, and the gun's box magazine contained 600 rounds. (Author's Collection)

unqualified to handle the latest equipment. Having to train on older aircraft only compounded the problem, with a lack of spare parts and, consequently, reduced operational readiness resulting in fewer hours in the air. As early as January 1942, an attempt was made to supply training units with more modern aircraft, but numbers varied owing to the needs of the fleet and the inevitable attrition caused by combat.

The training of qualified technician-gunners, which was critical in the year before the war, continued to a be major problem after Pearl Harbor. To address these issues new schools were quickly established, and the rapid expansion of the training program began.

The men who manned the free guns were technicians with wings. They were rated Aviation Ordnancemen (AOM), Aviation Radiomen (ARM), and Aviation Machinist's Mates (AMM), and were known collectively as Combat Aircrewmen. Their training began with six weeks of boot camp, where they would get a preview of radio code, voice communications, visual signalling, recognition, gunnery, and ordnance. Physical training was also a big part of the syllabus, being designed to keep them fit and alert and ready for the rigors of air combat.

After multiple aptitude tests, each trainee would be screened to determine their speciality – AOM, ARM, or AMM. Shortly after that, they would be shipped out to one of the Naval Air Technical Training Command basic "A" schools, where they would qualify for a third-class petty officer rating. In addition to fulfilling their requirements for a third-class rate, the aircrewmen received basic instruction in gunnery and visual signaling. This began with the study of free gun sighting, range estimations, and deflection shooting using the ring-and-bead sight. Next step was live firing using shotguns on the trap and skeet fields. Here, the trainee learned the principles of deflection shooting and hitting a moving target. This was followed by signals instruction in all its forms – Morse code, over-the-air voice, blinker lights, semaphore, or reading signals flags.

Another big part of the gunner's training involved ship and aircraft recognition. The correct identification of enemy aircraft and ships often meant the difference between victory or life and death in the air. The early stages of recognition training was based on the so-called WEFT (Wings, Engine, Fuselage, Tail) system, and combat quickly revealed its limits. It was too slow, as air combat required almost instantaneous recognition. In May 1942 a new program was adopted called the Ohio State System. Using slides, student gunners were exposed to images of aircraft starting at one-tenth of a second. The Ohio State System was universally adopted, being taught both in the fleet and in practically all training schools.

The "last lap" of the aircrewmen's tuition was two months with an SBD operational training squadron. After nine months of training, the radioman-gunner was awarded the US Navy's distinctive silver and gold wings and listed ready for combat.

SBD-3 DAUNTLESS COCKPIT

1. Control column
2. Carburetor air control
3. Cowling flap control lever
4. Autopilot "on-off" switch
5. Parking brake handle
6. Gun trigger switch
7. Cockpit ventilator
8. Engine primer
9. Oil cooler air scoop control
10. Ignition switch
11. Starter meshing pull
12. Windscreen hot air control
13. Airspeed indicator
14. Turn-and-bank indicator
15. Rate-of-climb indicator
16. Altimeter
17. Directional gyro control unit
18. Bank-and-climb control unit
19. Check-off list
20. Combined oil/fuel/ temperature gauge
21. Manifold pressure gauge
22. Tachometer
23. Clock
24. Engine temperature gauge
25. Outside air thermometer
26. Autopilot pressure gauge
27. Fuel quantity gauges
28. Magnetic compass
29. Mk III telescopic gunsight
30. M2 0.50-cal. machine guns with charging handles
31. Cockpit lights
32. Pilot's seat
33. Landing gear position indicator
34. Throttle lever
35. Mixture control
36. Propeller pitch control
37. Arresting hook control lever
38. Hoisting sling attachment points
39. Blower control lever
40. Bomb release lever
41. Bomb-aiming lever
42. Navigation board
43. Electrical distribution panel
44. Emergency hydraulic pump handle

A6M2 ZERO-SEN COCKPIT

1. IJNAF Type 98 reflector gunsight
2. Artificial horizon
3. Turn-and-bank indicator
4. Compass
5. Type 97 7.7mm machine guns
6. Rate-of-climb indicator
7. Fuel pressure gauge
8. Tachometer
9. Cylinder head temperature gauge
10. Oil temperature gauge
11. Intake manifold pressure gauge
12. Oil cooler shutter control handle
13. Ignition plug charger switch
14. Brake pedals
15. Oxygen control
16. Oxygen pressure gauge
17. Oxygen quantity gauge
18. Control column
19. Wing fuel quantity gauge
20. Fuselage fuel tank quantity gauge
21. Circuit breakers
22. Fuel injection pump
23. Engine main switch
24. Radio direction indicator
25. Altimeter
26. Exhaust temperature gauge
27. Clock
28. Airspeed indicator
29. Interior lights
30. Radio homing control unit
31. Type 3 Mk I radio control panel
32. Arresting hook retraction handle
33. Arresting hook/flap down angle indicator
34. Radio homing equipment control lever
35. Cowl gills control handle
36. Cockpit ventilation air intake
37. Seat adjustment lever
38. Pilot's seat
39. Elevator trim tab control handle
40. Machine gun safety lever
41. Throttle
42. Machine gun selector switch
43. Propeller pitch adjustment lever
44. Mixture control lever
45. Drop tank release lever
46. Bomb release levers
47. Switchboard
48. Flap control
49. Landing gear lever
50. Wing tanks fuel gauge
51. Fuselage/wing tanks switching cock
52. Wing tanks selector lever
53. Emergency gear down lever
54. High-altitude automatic mixture control

IJNAF PILOT TRAINING

Would-be armorers destined for service with an operational SBD unit practice loading rounds into the magazine for one of the forward-firing 0.50-cal. weapons at a naval air station in the US in 1943. The empty centerline bomb crutch is clearly visible beneath the SBD. (NHHC)

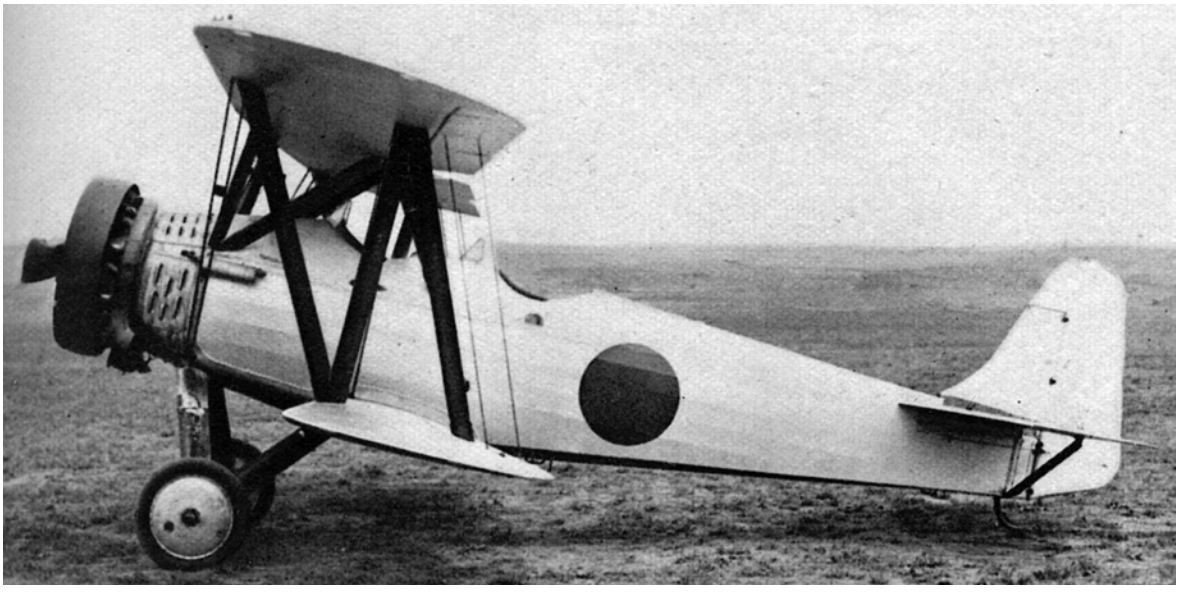
A fundamental difference between IJNAF and US Navy pilot training in the years leading up to World War II centered on contrasting philosophies in respect to military manpower. US armed forces traditionally relied on a core of trained professionals who maintained a small military force in peacetime, backed by a reserve force, and who in war would lead a greatly expanded military mobilized from the civilian population. The IJN, in contrast, adopted a philosophy of "quality over quantity" in both peace and war, creating a limited cadre of exceptionally well-trained and experienced officers and men equipped with superior weapons.

This philosophy was in tune with the IJN's obsession with the "Decisive Battle" concept – the view that one supreme engagement would decide the outcome of any war. The IJN planned for a short, victorious war, not a war of attrition. As a result of this philosophy, up until shortly before the outbreak of the Pacific War, the IJNAF lacked the infrastructure for mass pilot and aircrew training. Its existing pilot training scheme was selective in the extreme, producing a very small number of exceptional pilots who represented only a fraction of those considered eligible.

The IJNAF drew its pilots from three sources. A small number of officer pilots came from the IJN Academy at Etajima, near Hiroshima, and they were duly trained in their own separate classes for eight months to a year. The vast majority of IJNAF pilots – upwards of 90 percent – were non-commissioned officers and enlisted men. Many came from within the ranks of the IJN through a highly selective and competitive examination process. The IJNAF also recruited young men directly from the civilian world through the so-called Yokaren (Flight Reserve) programs. The initial program set up in the early 1930s recruited boys aged 15 to 17, who were given three years of education and flight training. In 1937 the IJNAF began a new program to recruit young men who had completed three-and-a-half years of their middle school education, thereby reducing the time spent before they commenced flight training to 18 months. This subsequently became the largest source of aviation cadets.

The majority of the IJNAF's pilots were enlisted men. These extremely youthful trainee pilots are posing with a K5Y1 Type 93 Intermediate Trainer. (Edward M. Young Collection)

During their pre-flight training, the students were regularly subjected to strict regimentation, frequent corporal punishment, and demanding physical activities. Future ace Saburo Sakai recalled that he was one of only 75 recruits from a pool of 1,500 that were accepted for flight training



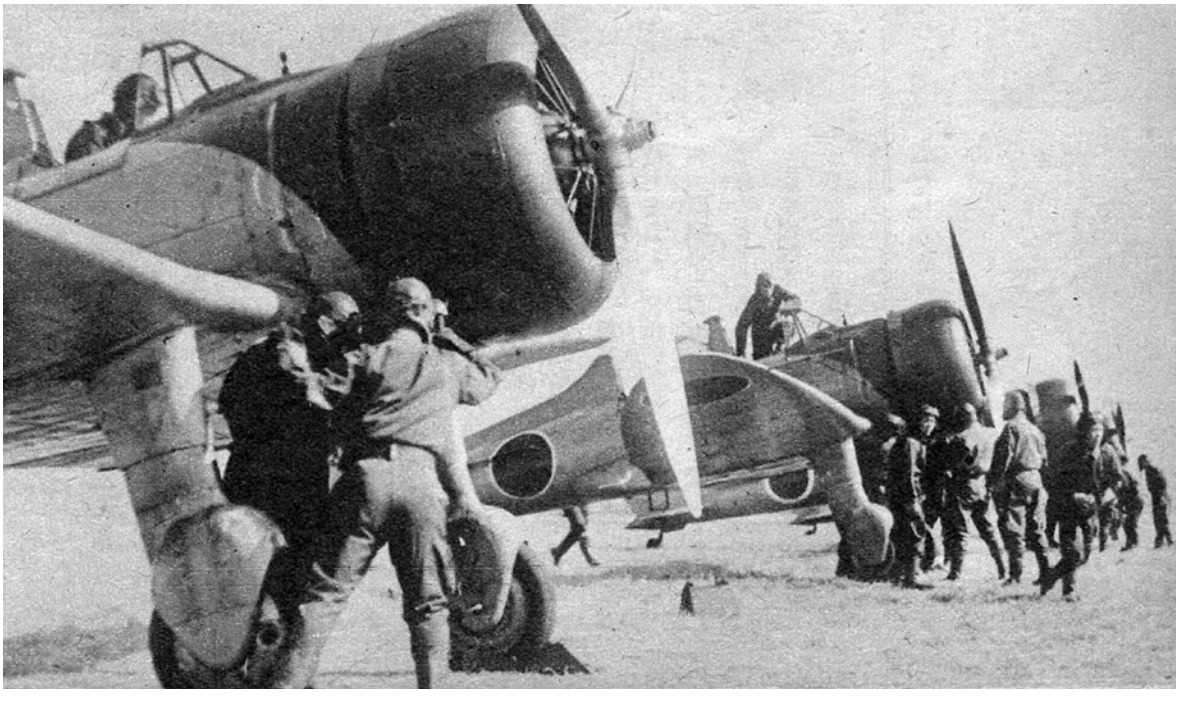
The Yokosuka K5Y1 Type 93 Intermediate Trainer, nicknamed "akatombo" (red dragonfly) for its yellow training colors, was familiar to all IJNAF pilots. No fewer than 5,770 examples were built between 1933 and 1945, making it the most-produced Japanese training aircraft. (Edward M. Young Collection)

following the completion of this initial phase. In 1940, the training programs for enlisted men were revised and flight training standardized. Prior to this, the flying training program had lasted seven to nine months and covered primary and intermediary instruction.

In the primary phase, trainees began instruction on the Yokosuka K2Y1/2 Primary Trainer, before moving on to the Yokosuka K5Y1/2 Type 93 Intermediate Trainer. Practice included the usual basic flying skills, aerobatics, formation flying, instrument flying, and cross-country navigational exercises. After accumulating around 100 flying hours, and passing comprehensive examinations of their flying skills, trainees were assigned to a specialized aircraft type (fighters, dive-bombers, torpedo-bombers, multi-engined bombers, etc.) and began their advanced training program, lasting around three months. Neophyte fighter pilots joined Saeki, Omura, or Oita Kokutais for training in older operational aircraft, flying the Nakajima A2N Type 90 and A4N Type 95 Carrier Fighters, before moving on to the Mitsubishi A5M Type 96 Carrier Fighter when the A6M Type 0 Carrier Fighter replaced it in frontline units.

During their advanced training, students tallied another 100–150 flying hours, during which time they were introduced to tactics and basic combat maneuvers, aerial gunnery, more formation flying, and aerobatics in heavier and more powerful operational aircraft. Upon completion of their entire training program, enlisted pilots would have accumulated around 250–300 flying hours and officer pilot trainees around 400 hours. After 1940, as the IJNAF began to expand its training program, the length of the latter was reduced to ten months to increase the output of pilots.

After joining a tactical unit, the newly graduated pilots continued their training. Up until the outbreak of the Pacific War, the IJNAF's tactical units served the same function as operational training units. This was not necessarily a burden, as new pilots were often assigned to new units forming in Japan. The new pilots undertook an intensive training



IJNAF student pilots prepare for a lesson in the A5M4-K advanced fighter trainer. The A5M4-K was a two-seat version of the Type 96 Carrier Fighter that supplemented older operational types during basic combat training. (Edward M. Young Collection)

program to refine the combat skills they had begun to learn during their advanced training course. Working with their more experienced colleagues, they practiced combat tactics, combat formations, gunnery and, for the carefully selected few, carrier operations. Only the very best pilots were selected for the carrier air groups – these were the IJNAF's elite, the "best of the best."

During the war in China, newer pilots could be gradually broken into combat and carefully shepherded by the veterans in the air group. Saburo Sakai recalled how he was assigned to fly close air support missions for the Imperial Japanese Army (IJA) for several weeks before he was allowed to join the veteran fighter pilots on combat air patrols (CAPs).

The IJNAF's pilot training system was successful in producing a relatively small number of superbly trained and exceptionally skilled flyers. In December 1941, the IJN went to war with approximately 3,500 pilots, of which some 600 were assigned to the carrier air groups. They each had an average of between 600–800 flying hours, and many benefited from having seen combat in China. But there was no real reserve of pilots, and as nearly every unit became heavily involved in combat duties, there was little time to perform the operational training role for newly assigned pilots.

During 1941, the IJNAF developed a plan to train upward of 15,000 pilots a year, but with the outbreak of the war this fell by the wayside. The training system was subsequently expanded to produce around 2,000 pilots a year, but events would prove that this was not enough. As Mitsuo Fuchida and Masatake Okumiya (both formerly IJN officers) wrote in their history of the Battle of Midway, the IJN high command "failed to realize that aerial warfare is a battle of attrition, and that a strictly limited number of even the most skillful pilots could not possibly win out over an unlimited number of able pilots."

STANLEY "SWEDE" VEJTASA

Stanley Winfield "Swede" Vejtasa was born in Paris, Montana, on July 27, 1914. After completing his education at Montana State College and the University of Montana, he joined the US Navy in 1937 and commenced flight training on July 5, 1938 as an Aviation Cadet at Naval Air Station (NAS) Pensacola, in Florida. Vejtasa was awarded his wings of gold and ensign bars on July 13, 1939. At the time of the Pearl Harbor attack on December 7, 1941 he was assigned to VS-5 aboard *Yorktown*, flying the SBD-3.

A skilled, aggressive aviator, Vejtasa first saw action in the Battle of the Coral Sea on May 8, 1942. Following US strikes against the IJN carriers *Shokaku* and *Zuikaku*, *Lexington* and *Yorktown* were attacked by IJNAF torpedo- and dive-bombers. Eight SBD crews, including Vejtasa and his radioman-gunner ARM3c Frank Wood, from VS-5 were assigned as low-level anti-torpedo interceptors. As Vejtasa engaged incoming B5N2s at wavetop height, he was attacked by seven Zero-sens. Although the latter held the advantage, Vejtasa flew his SBD aggressively, offering his opponents only high-angle deflection shots. In the short battle that ensued, the Japanese pilots shot down four SBDs, with all crews lost. Vejtasa was credited with three Zero-sens destroyed – only one A6M2 actually ditched with battle damage.

For his part in the sinking of the Japanese carrier *Shoho* on May 7, and his actions the following day, Vejtasa was awarded his second Navy Cross (his first had come following VS-5's attack on IJN shipping off Salamaua and Lae on March 10). The citation for the medal read, in part, "on May 8, while on anti-Torpedo Plane patrol, he fiercely engaged the combined attack of enemy bombing and Torpedo Planes heavily supported by fighters, which attacked our forces. Vejtasa'a conscientious devotion to duty and gallant self-command against formidable odds were in keeping with the highest traditions of the United States Naval Service."

In recognition of his natural fighting skills, Vejtasa was assigned to the newly formed, F4F Wildcat-equipped, VF-10 aboard *Enterprise*. On October 26, 1942, the Battle of the Santa Cruz Islands would see Vejtasa earn his third Navy Cross. Leading a division of fighters on CAP, he spotted three D3A1 "Val" dive-bombers headed for *Hornet* and quickly despatched two of them. Shortly after, 11 B5N2 "Kate" torpedo-bombers appeared heading for *Enterprise*. With his wingman close behind, Vejtasa flew through "friendly flak" and shot down five B5N2s in a matter of minutes. He was one of the US Navy's first "aces in a day," earning him his third Navy Cross.

Vejtasa returned to the US in May 1943, becoming an instructor at NAS Atlantic City, in New Jersey. Although he later commanded VF-97 at NAS Alameda, in California, he saw no further combat. In June 1945 he was given command of Light Carrier Air Group 44, although it was disbanded shortly after VJ Day. With the war over, his final score totaled 10.25 enemy aircraft destroyed.

Vetjasa remained in the US Navy post-war, flying most of the early-generation jet fighters in his role as a test pilot. When the Korean War broke out in June 1950, he returned to sea and served as the air officer aboard USS *Essex* (CV-9) from January 1951 to April 1953. Vetjasa returned to flight testing (at Naval Ordnance Test Station China Lake, in California) after the conflict had ended. There, he flew the F4H Phantom II and worked on new weapons systems such as the AIM-9 Sidewinder heat-seeking air-to-air missile. In November 1962, Vejtasa took command of USS *Constellation* (CVA-64). One year later he became Commander, Fleet Air at NAS Miramar, California.

Retiring with the rank of captain on July 1, 1970, Vejtasa ended his career as one of the US Navy's most experienced Naval Aviators, having logged 9,000 hours of flying and 700 carrier traps. He passed away on January 23, 2013.

Lt Stanley "Swede" Vejtasa. (NHHC)

KENJI OKABE

Kenji Okabe was one of the few IJNAF pilots to claim multiple SBD victories in a single mission, being credited with three destroyed (along with three F4F Wildcats, and two more as probables) in one day during the Battle of the Coral Sea.

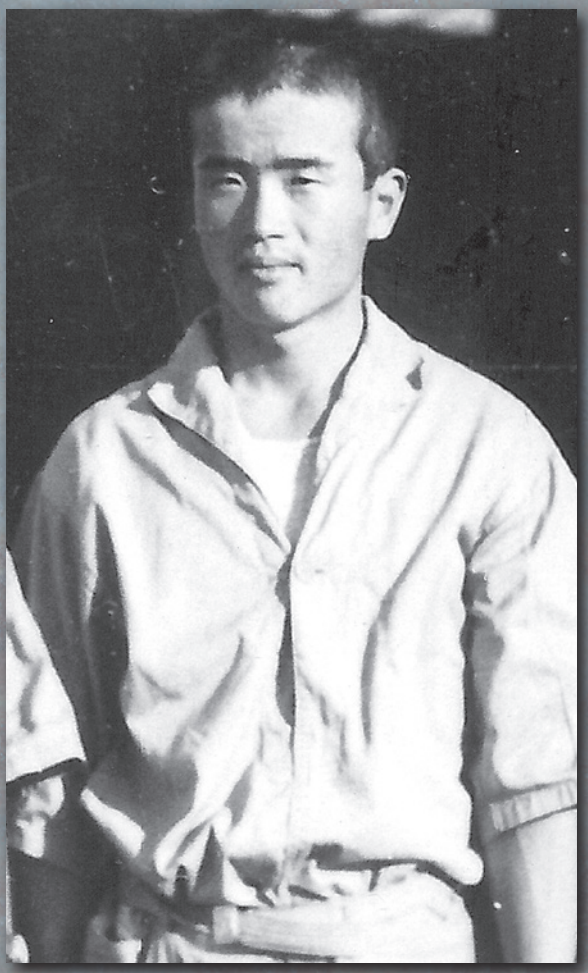
Born in the city of Fukuoka in May 1915, Okabe joined the IJN after graduating from Shuyukan High School. He was subsequently part of the 37th Pilot Training Class, along with fellow future ace Saburo Sakai, completing his training in November 1937. Okabe then briefly served with Saeki and Ohmura Kokutais, before being assigned to A5M-equipped 12th Rengo Kokutai in China. The RoCAF was rarely encountered, however, and Okabe failed to claim any aerial victories.

On the eve of war in the Pacific, Okabe was transferred to *Shokaku* after qualifying as a carrier pilot. When the IJNAF struck Pearl Harbor on December 7, 1941, he was disappointed to find himself assigned to a CAP over the carrier task force. It was not until April 9, 1942 that Okabe was finally able to fire his guns at Allied aircraft. During a carrier attack on the Royal Navy base at Trincomalee, on Ceylon, he claimed the destruction of two RAF Hurricane IIs from No. 261 Sqn.

Okabe's legendary Battle of the Coral Sea sortie took place on the morning of May 8, 1942. Assigned CAP duty once again, he waited at a higher altitude and picked the SBDs off as they pushed over into their attack dives – Okabe repeated this tactic several times against both Dauntlesses and Wildcats. Yet, despite making eight claims, his carrier, *Shokaku*, was hit and its flightdeck rendered unusable, forcing Okabe to ditch alongside the vessel. He was quickly rescued. In another classic example of overclaiming, the *Shokaku* and *Zuikaku* Zero-sen CAP claimed 39 American aircraft destroyed between them. Of that total, 16 were SBDs. IJNAF losses amounted to two Zero-sens shot down and two damaged. As far as can be determined, A6M pilots actually shot down two SBDs and three F4Fs.

In July 1943, Okabe embarked on board the repaired *Shokaku*, which was bound for Truk Atoll. On November 1 he and the rest of the carrier's air group was sent to Rabaul to help defend the IJN fortress in New Guinea. He took part in a number of interceptions whilst here as the Allies launched a concerted aerial campaign to neutralize Japanese forces in the area. Returning to Truk with the air group on November 13, Okabe saw further action over the Marshall Islands at month-end, prior to being posted back to Japan to join Ohmura Kokutai. In July 1944 he joined newly formed 634th Kokutai, and was sent into action with the unit over Leyte three months later as part of the ill-fated defense of the Philippines.

Returning to Japan in December following the virtual annihilation of his unit, Okabe was assigned to 601st Kokutai and participated in the battle for Okinawa in April 1945. Strongly opposed to the concept of kamikaze attacks, which dominated IJNAF operations in the final months of the war, Okabe survived the conflict with a total of 15 victories to his name.



FP01c Kenji Okabe. (Tony Holmes Collection)

COMBAT

"The example set by the rear seat gunners, all Aircraft Radiomen or strikers, was particularly outstanding. Time and again their accurate, tenacious fire saved pilots and planes of this squadron, and made the Japs lukewarm regarding that most important item in aerial gunnery – range."
Lt Cdr Robert E. Dixon, VS-2 CO in his Report of Action for May 8, 1942

SBD TACTICS

In December 1941 the US Navy and US Marine Corps were equipped with ten squadrons of SBD-1/2/3s. *Lexington, Saratoga,* and *Enterprise* embarked 113 SBD-2/3s between them, with one shored-based US Marine Corps squadron equipped with 22 SBD-1/2s in Hawaii. Each fleet carrier embarked one VS (Scout) and one VB (Bomber) squadron with between 18 and 21 aircraft. VS and VB units were crossed-trained in both roles, although the VS pilots also received air-to-air gunnery training.

In the carrier battles of 1942, scouting played a critical role. Both the IJNAF and the US Navy knew that spotting the enemy first and striking first were key to achieving victory. The SBD was perfectly suited to the scout doctrine. Typically armed with a single 500lb bomb apiece, a pair of SBDs would usually undertake scouting missions so that they could provide mutual navigation support and defensive firepower. Two Dauntlesses also doubled the chances of achieving a hit on any enemy vessels that were spotted.

The primary mission for VS units was reconnaissance and alerting the task force to the presence of enemy ships. The SBD radioman-gunner was critical to mission

success, having to be proficient in both communications and gunnery. In 1942, voice communication was plagued by radios that had only limited range and were routinely unserviceable. Morse Code was the most reliable way to get a message back to the task force, and the radioman-gunner was trained to keep sending any sighting reports until his message was acknowledged. If the conditions allowed, the SBD scout would attack using available cloud cover, or by keeping "up sun" of the hostile ships.

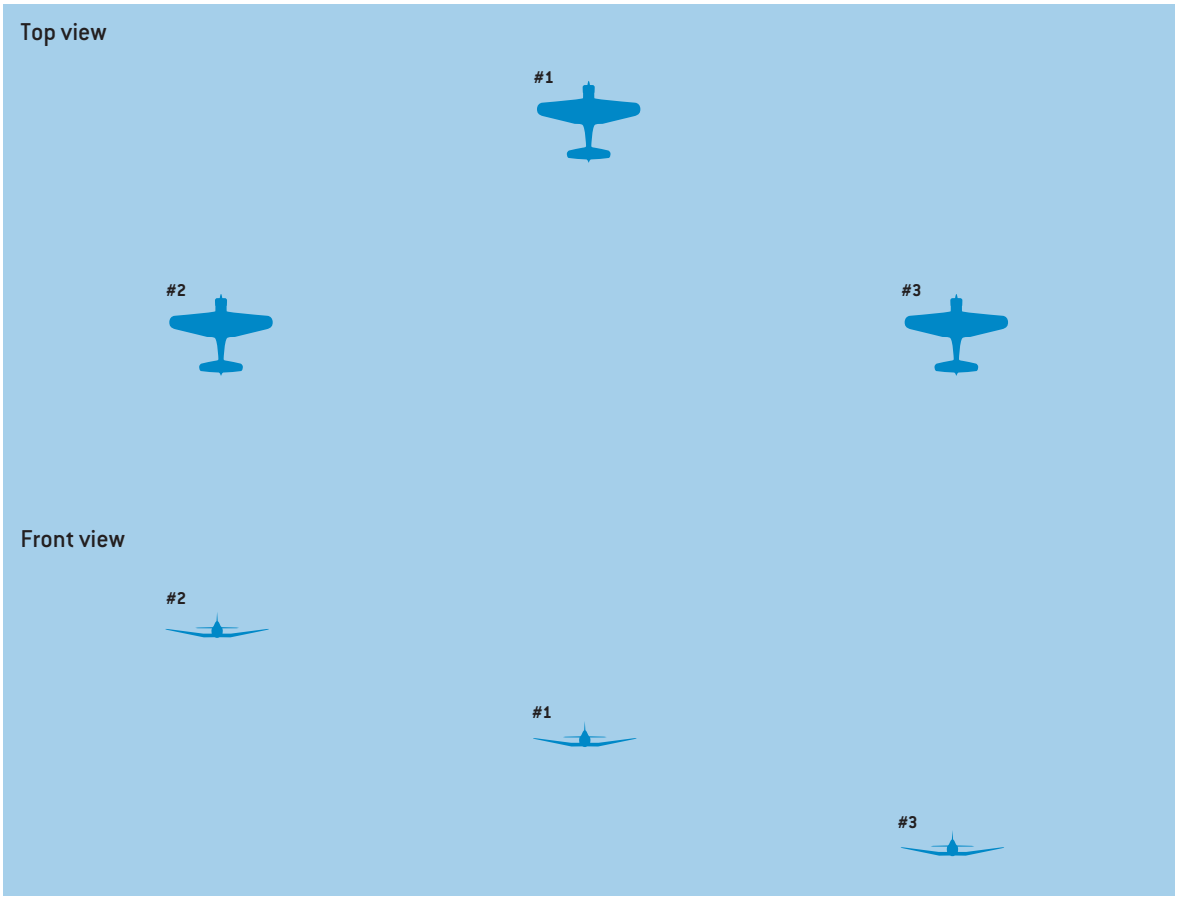
A Dauntless radioman-gunner aims his twin, loaded, Browning M1919 0.30-cal. machine guns skyward for the benefit of the photographer. The weapons' 0.30-06 cartridges are belted with one round in four being tracer, the latter distinguished by black-tipped bullets. Combat aircrewmen relied on a standard iron sight (seen here in the folded position) when aiming the guns, and the rear cockpit was fitted with 43lb of protective armor plating. The eight inches separating the barrels of the 0.30-cal. machine guns in the twin mount created the optimistic, but false, impression that the radioman-gunner could fire straight astern and have the bullets pass harmlessly on either side of the tail. (NHHC)

The SBD was the US Navy's primary strike weapon, being capable of hitting a maneuvering ship at high speed in open water with a good degree of accuracy. A full-scale bombing attack involved up to 36 SBDs in two 18-aircraft squadrons. Each unit would approach its target in three six-aircraft divisions. Each division comprised two sections of three aircraft flying in a V-formation. Each wingman was positioned either side of the leader and slightly behind. The entire 18-aircraft formation flew in a stepped down formation, with the lead division at the top, followed by the middle and lower divisions.

Each SBD radioman-gunner had a range of 180 degrees from side to side and 70 degrees in the vertical. Each three-aircraft section had six rear guns (in the SBD-3), with 8,000 rounds of ammunition between them. For head-on attacks, the pilot could respond with two 0.50-cal. machine guns. SBDs also had the luxury of a second pair of eyes. Unlike fighter pilots, who had a massive blind spot to the rear of their aircraft, Dauntless crews were rarely surprised by enemy fighters. Back-seaters could also anticipate an enemy fighter's moves, and warn the pilot when to side slip or turn into his attacker to throw off his aim. Veteran rear gunner ARM3c Dave Cawley believed this arrangement provided for excellent defense:

> I found the gunner's position in the SBD quite comfortable. It was also very windy. If you stayed behind the canopy cover, it was fine, but if you were going fast enough, any movement into the slipstream felt like you were being hit by a board.
>
> In my experience, I mostly encountered Zeros. We were pretty proud of our three-ship element. If we could get three guys together, with a good gunner in the lead plane to step down those wingmen up and down, we could suck'em in close and raise a lot of Cain.

Approach to the target varied between 14,000 to 15,000ft. As the dive point approached, the squadron shifted from V-formations into echelon. Reducing throttle, each pilot extended his dive brakes to slow his decent. Standard dive angle was between 70 and 75 degrees at some 240mph. From push over to bomb release usually took just



The standard tactical formation employed by US Navy and US Marine Corps SBD units was the three-ship element. The leader was in the center, with a single aircraft on either side, behind and at different heights, depending on instructions from the element leader. This gave the formation the best fields of fire and a degree of protection when attacked from beneath – the favored direction of approach for Zero-sen pilots.

30 to 35 seconds. Once in a dive, the SBD was difficult to intercept. Its constant slow speed meant diving Zero-sens had just a few seconds' firing time. After bomb release, the pilot quickly retracted the dive brakes and headed for the rendezvous point. This was when the SBD was most vulnerable. A single Dauntless at low-level stood little chance against a determined fighter attack.

The aircraft's nose-mounted guns gave it an adequate punch when presented with an opportunity to shoot down a Zero-sen from astern. While a number of pilots were credited with air-to-air kills, most preferred safety in numbers and evasion to secure their survival. Interception and pursuit of enemy fighters was not the SBD's primary mission.

IJNAF FIGHTER TACTICS

The basic combat unit in the IJNAF was the three-aircraft shotai, which was a variation of the three-fighter V-formation consisting of a leader and two wingmen that was common to most of the world's air forces in the interwar period. While perfectly adequate for flying to and from a target, IJNAF fighter pilots found that in actual combat a tight V-formation was too rigid and less than effective. They duly developed

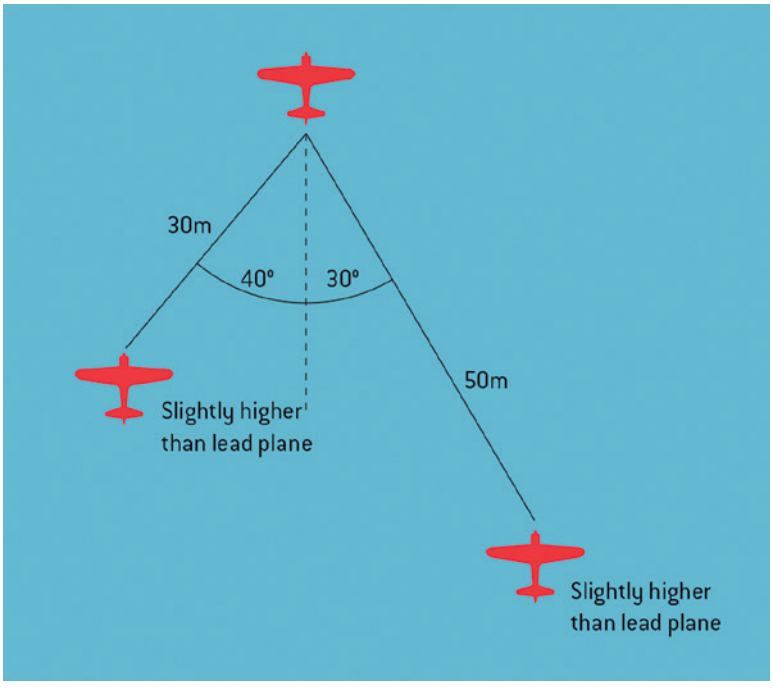
a looser V-formation, with the wingmen flying farther back and at different altitudes, instead of being tied closely to the leader.

In this revised combat formation, one wingman would fly 200 meters behind the leader and the second wingman around 300 meters behind, with one stepped up 200 meters in altitude and the second some 300 meters higher. In this formation, the wingmen were not glued to the leader and concentrating on avoiding collisions. Instead, they could spend time scanning the sky for enemy aircraft. The shotai leader initiated the attack on an enemy aircraft or formation, and he could deploy his wingmen in line astern or line abreast as the tactical situation required for sequential passes against the target.

While excelling at individual combat during the first year of the Pacific War, Zero-sen pilots more often employed hit-and-run tactics against an enemy aircraft, with each pilot in the shotai diving down to make an individual firing pass, pulling out underneath the enemy aircraft and climbing swiftly back up to altitude to regain the initiative. Alternatively, the leader could have one of the wingmen remain above the target as top cover.

To be effective in the turmoil of air combat the pilots within the shotai required superlative flying skills, exceptional coordination, and an almost intuitive understanding and anticipation of the actions, or reactions, of the other members of the formation. This was especially true for the land-based Zero-sen fighter units, who often removed the radios from their aircraft. Perfecting this coordination came from hour after hour of relentless practice. The Zero-sen units that went to war in December 1941 benefited from having experienced pilots who had trained together for months.

However, as attrition began to take its toll, newer replacement pilots came in who did not have the same levels of experience. With the Zero-sen units heavily involved in combat, there was less time to devote to training missions, where pilots could perfect their coordinated shotai tactics. Without radio communication, coordination of the formation with less well-trained pilots became more difficult. Although these formation tactics proved less adaptable to the realities of air combat over the South Pacific, the IJNAF took an inordinate amount of time to institute changes.



The IJNAF's basic fighter formation consisted of three Zero-sens flying in a vee. With combat experience, Japanese pilots modified the basic vee into a looser formation, with the wingmen staggered above and behind the leader to give the formation more tactical flexibility and a better lookout for enemy aircraft.

IJN CARRIER DEFENSE

At the outbreak of the Pacific War, IJN carrier air defense was fatally compromised by a lack of shipborne radar, efficient fighter control, and ineffective anti-aircraft guns. Carrier doctrine relied on the first

strike capability at the expense of fleet defense. It was a fatal flaw, and one of the main reasons for the SBD's success during 1942. At the time of Midway, Japanese fleet carriers typically had 18 Zero-sens on board, with nine dedicated to CAP. A standard CAP comprised one three-fighter shotai airborne, a second shotai ready for launch, and a third in a lesser state of readiness.

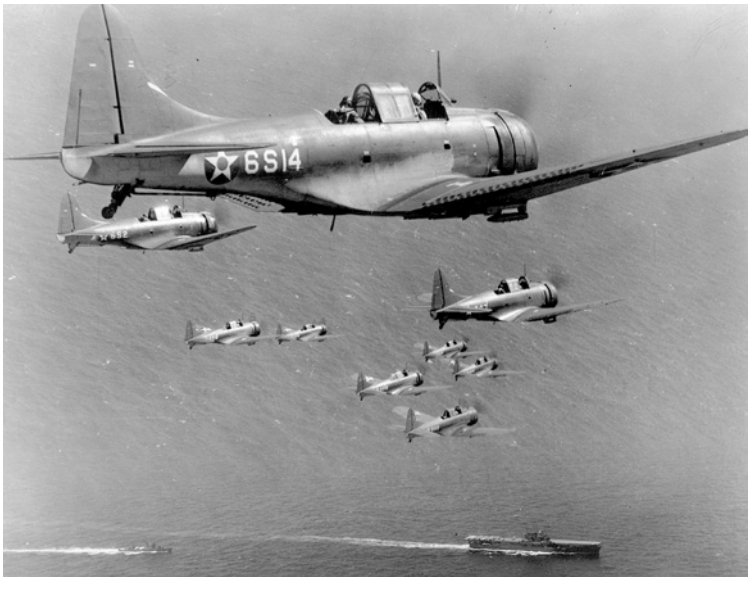
The IJN relied on surface lookouts on escorting ships to spot incoming raids. To alert the CAP, escort vessels fired their main batteries or produced smoke. Adding to the problem of communication with airborne fighters was the inferior quality of Japanese radios and the almost complete lack of shipborne guidance for the CAP. Once a raid was detected, it was impossible to coordinate a defense against multi-axis, multi-altitude attacks. In the first two carrier battles of the Pacific War, IJNAF CAPs simply crumbled, leaving vessels exposed. In many ways the outstanding qualities of the Zero-sen and its pilots were wasted by a system doomed to fail.

For both Zero-sen and SBD crews, combat in the Pacific War came early, with the first clash between the two types taking place during the morning attack on Pearl Harbor on December 7, 1941. After delivering US Marine Corps F4F Wildcats to Wake Island, *Enterprise* had headed for "Pearl." Since November 28, Vice Adm William F. Halsey, commander of TF 8, had had the carrier on a war footing.

From a point 75 miles southwest of Kaula, in the Hawaiian islands, 18 SBDs (13 scouts from VS-6 and five bombers from VB-6) were launched in two-aircraft sections to search the eastern horizon. At 0800 hrs just west of "Pearl," Carrier Air Group Commander Lt Cdr Howard Young and his wingman Ens Perry L. Teaff of VB-6 spotted a number of aircraft and the black smudges of anti-aircraft fire over the US Marine Corps air station at Ewa. Moments later, a single-engined aircraft approached, drawing to within 75ft of Teaff's tail before 7.7mm machine gun rounds found their mark as the Zero-sen made a pass at the two SBDs.

In order to fend of the lone attacker, Young and Teaff dove towards Ford Island, but remained together as Teaff's radioman-gunner, RM3c E. P. Jinks, engaged the A6M2. Dissuaded from further attacks, or simply out of ammunition, the Zero-sen pilot broke off and left Young and Teaff to face a barrage of friendly fire as they landed at Ford Island. Others were less fortunate. Ens John H. Vogt of VS-6 tangled with three Zero-sens at low altitude after becoming separated from his CO. In the ensuing dogfight, it is believed that Vogt collided with one of his attackers, sending both his SBD and the unidentified A6M2 crashing into the sea near Ewa.

As Lt Clarence E. Dickinson and Ens John R. McCarthy of VS-6's seventh sector team approached Barbers Point, they spotted



SBDs from VS-6 approach *Enterprise* on Navy Day, October 27, 1941. Six weeks later, a number of these aircraft were involved in the ill-fated sector search that ended with the destruction of six Dauntlesses on the morning of December 7, 1941. (NHHC)

Against the backdrop of Mt Lawes, these 3rd BG A-24s are taxiing out for a combat mission at 14-Mile Drome, Port Moresby, in May 1942. By July, the dive-bombers had been effectively retired to Australia due to their vulnerability to Zero-sens, although eight had to be rushed back to Port Moresby on July 22 following the Japanese landings at Buna. Aircraft of the 8th BS were decimated by A6M2s from Tainan Kokutai one week later. (Michael Claringbould Collection)

anti-aircraft fire, bomb explosions, and dense smoke. While trying to make sense of what they saw, both aircraft were bounced at 4,000ft by SEA1c Isao Doigawa and PO3c Shin-ichi Suzuki from *Soryu*. As McCarthy maneuvered his SBD to support Dickinson, he was hit, falling away in smoke and flames. McCarthy managed to bail out, but his gunner, RM3c Mitchell Cohn, was killed. As four more Zero-sens then arrived on the scene, Dickinson began evasive maneuvers to throw off the attackers' aim. His radioman-gunner, RM1c William C. Miller, also returned fire, only to be wounded early in the combat. In the end Dickinson could not evade his pursuers, and cannon shells ripped into his starboard wing and set it on fire. As his SBD fell into a right-hand spin, Dickinson bailed out at just 800ft. Miller did not survive.

Minutes later, Doigawa and Suzuki also engaged Lt(jg) Frank Patriarca and his wingman, Ens Walter Willis. Although the sector team leader succeeded in escaping, Willis and his radioman-gunner, Chief C. J. Ducolon, did not. Their SBD disappeared near Oahu's south coast.

In total, five SBDs were shot down by IJNAF aircraft (the fifth one had fallen to several D3As from *Shokaku* and *Zuikaku*) and a sixth had succumbed to friendly fire. The one-sided clashes off the coast of Hawaii on December 7 had graphically shown just how deadly an opponent the Zero-sen could be.

The Douglas dive-bomber next encountered the A6M over Lae on the morning of April 7, 1942, and on this occasion aircraft from both sides would be lost. Eight A-24 Banshees from the USAAF's 8th Bombardment Squadron (BS) had sortied from Kila, near Port Moresby, and headed for the IJNAF airfield at Lae. Achieving total surprise, the Banshee crew succeeded in hitting nine aircraft with their 500lb bombs and 25lb incendiaries. Michael Claringbould and Peter Ingman described what happened next in their book, *South Pacific Air War vol 2 – The Struggle for Moresby*:

> After their dives, the Banshees swept out over Huon Gulf before taking up a heading for Port Moresby and seeking a mutually supportive defensive formation that made best use of their rearward-facing twin machine guns. However, both FPO3c Sachihisa Tan and FPO2c Un'ichi Miya of Tainan Kokutai, who had been flying a CAP over Lae and had initially failed to spot the A-24s due to cloud cover, had seen the aircraft and commenced their attack in time to chase the last few Banshees as they pushed over in their dives.

A short time later, while flying low over the water, 2Lt Edward Chudoba found a Zero-sen on his tail – this was Tan, who hit the dive-bomber on his first pass, but during a second he presented himself as a target to Chudoba's gunner, Sgt George Stevens. Tan was probably killed by Stevens' fire, as his Zero-sen immediately dove and splashed into the blue-green water below.

Miya landed safely back at Lae, where he claimed a single kill. This was the A-24 crewed by 2Lt Henry Swartz and his observer, Sgt John Stevenson, who were last seen at the top of their dive by other crews. Their precise fate is unclear: there are obscure Japanese records that allude to the possibility they were captured and taken to Lae. Thereafter, no trace of them exists.

Four days later, the 8th BS again targeted Lae, and on this occasion the A-24 of 2Lt Gus Kitchens and gunner Sgt George Kehoe was shot down by high-scoring Tainan Kokutai ace FPO1c Satoshi Yoshino.

Carrier-based Zero-sens and SBDs would clash once again on May 7 during the Battle of the Coral Sea, when the IJN's Striking Force attempted to attack Port Moresby. The Pacific Fleet's TF 17 was despatched to engage the Japanese vessels, and the light carrier *Shoho* (whose air group included ten A6M2s and two A5M4s) was targeted by more than 50 SBDs from *Lexington* (VB-2 and VS-2) and *Yorktown* (VB-5 and VS-5). As the SBDs of VS-2, led by unit CO Lt Cdr Robert E. Dixon, moved into echelon formation to commence their dives from 12,500ft, two Zero-sens made a pass at the lead section. The fighters were flown by WO Shigemune Imamura and FPO2cs Tadao Aoki and Takao Inoue, who were too late to prevent the attack. Coming back on the throttle, Dixon opened the dive flaps and nosed over. The rapid deceleration caused the fighters to flash past.

The fourth SBD in VS-2's attack formation was flown by Ens John Leppla, with ARM3c John Liska as the radioman-gunner. Two Zero-sens tried to follow them down, firing as they dove, but they were driven off by Liska's single 0.30-cal. machine gun. As Liska dealt with the fighters, one dove past, headed for the SBD in front of Leppla. Briefly rolling off his attack dive on the carrier, Leppla put his telescopic sight on the A6M2 in front of him and opened fire. The IJNAF pilot quickly broke off his attack, freeing Leppla to return to the main target and registering a near miss. In just 30 seconds of combat Leppla and Liska claimed three Zero-sens shot down.

Shoho's 12 fighters and limited anti-aircraft defenses inflicted little damage on the SBDs once they were in their vertical dives. The Dauntless was most vulnerable during its pull-out and recovery to the rendezvous point, and a few SBDs fought running battles until the IJNAF fighters broke off. *Shoho* had suffered a devastating attack, and soon sank, while three SBDs from VS-2 and one from VS-5 had been shot down – almost certainly by the Zero-sen CAP. Several more Dauntlesses were damaged, including Leppla's SBD, riddled with 7.7mm and 20mm hits. Dauntless crews claimed six enemy aircraft destroyed in the course of the battle, five of them Zero-sens. Closer examination of IJNAF records confirms no SBD victories over any A6M2s.

The battle continued the following morning, with the SBDs once again leading the way. Shortly after 0800 hrs, scouts from both sides reported sightings approximately

ENGAGING THE ENEMY

It must be remembered that the first task of the SBD's radioman-gunner was not to shoot down enemy fighters, but to keep them from shooting him down. Getting the enemy to open fire out of range or cause him to break off with accurate fire was an essential part of the job. Armed with two AN-M2 0.30-cal. Browning machine guns, the Dauntless rear gunner had a reasonable field of fire, but lacked the ability to shoot either straight back because of the tail fin or down directly below the aircraft. This is where the SBD was most vulnerable. While the rate of fire of the twin Brownings was high, the 0.30-06 cartridge lacked hitting power.

The rear guns were equipped with both an iron gunsight and the Mk 9 gunsight. Developed in 1941 from the British Barr & Stroud GJ3 free gunsigh, the Mk 9 was standard equipment on all US Navy aircraft fitted with turrets and flexible gun positions from 1942 through to war's end. The rear gunner was well protected by 43lb of quarter-inch armor plating installed directly in front of his head and to either side of the guns.

210 miles from each other. The Americans got going first, launching a strike at 0847 hrs, followed by the Japanese at 0915 hrs. *Lexington* launched 22 SBDs from VS-2 and VB-2, followed by 24 from VS-5 and VB-5 off *Yorktown.*

As the strike groups entered the combat area the weather intervened. VB-2 was forced to 1,000ft as it maneuvered in and out of rain squalls in a desperate search for the Japanese carriers. With no ships in sight, VB-2 was forced to turn back. VS-5, led by Lt Cdr William O. Burch, had better luck. As its seven SBDs prepared to attack *Zuikaku*, the carrier found cover in a nearby rain squall, leaving *Shokaku* exposed. As

the SBDs approached, four Zero-sens scrambled, climbing for altitude. Just as Burch opened his dive flaps, the A6M2 CAP above him from *Zuikaku* also struck.

These aircraft, led by FPO1c Tetsuzo Iwamoto, had been patrolling over the carrier at 20,000ft when, shortly after 1030 hrs, the shotai leader spotted *Yorktown*'s incoming strike force at 17,000ft. Targeting the dive-bombers of VS-5, he led his shotai after them just as they began an attacking pass on *Shokaku*. Plunging after the enemy aircraft as they entered their 70-degree dives at 11,000ft, Iwamoto singled out the leading SBD flown by Lt Cdr Burch, and gave it a burst of 20mm fire as he flashed past – his closing speed was too fast from the diving pursuit to prevent him overshooting his target. Burch survived Iwamoto's attack, although the latter thought he had shot the SBD down.

The trio of Zero-sens then zoomed back up above the SBDs, before diving again into the action as the Dauntlesses released their bombs and began pulling out of their attack runs. Iwamoto and his two wingmen concentrated on an SBD damaged by an anti-aircraft shell, peppering it with fire and wounding pilot Ens John H. Jorgenson. As the damaged SBDs raced away from the target area at low level, Iwamoto broke off the pursuit and led his shotai in a climb back up to altitude once again, his duty to protect the carriers from other attacks being of primary importance. Lt Kiyokuma Okajima's shotai of four Zero-sens, launching from *Zuikaku* during the attack, also made a head-on gunnery run on the departing SBDs of VS-5, inflicting further damage on the Dauntlesses but failing to shoot any of them down before racing off in the direction of a developing attack by VB-5's SBDs on *Shokaku*.

FPO1c Kenji Okabe, 16th shotai leader embarked in *Shokaku*, also participated in CAP sorties defending the carrier from enemy attacks on May 8. His shotai was patrolling at 13,000ft when *Yorktown*'s strike force approached the IJN carriers at just after 1030 hrs. At first, Okabe did not spot the enemy aircraft and remained ignorant of warnings from the carriers as his radio had malfunctioned. The Japanese carriers, lacking radar, were highly dependent on the CAP spotting any incoming threats in order to launch the bulk of their fighters. Okabe led his shotai into action only after *Shokaku*'s anti-aircraft gunners had opened fire, alerting him to the developing attack.

Many of these A6M2 pilots assigned to *Shokaku* were involved in the pivotal campaigns of 1941–42, including the attacks on Pearl Harbor and Ceylon and the Battle of the Coral Sea. Amongst their number are aces Ichiro Yamamoto (front row, extreme left), Masao Sasakibara (sat next to Yamamoto), Masao Iizuka (second row, second from left), Jiro Matsuda (third row, third from left), Kenji Okabe (third row, fourth from left), Sadamu Komachi (third row, fifth from left) and Yoshimi Minami (fourth row, second from left). (Tony Holmes Collection)

Deciding to disregard the SBDs of VS-5 that were already being chased by Iwamoto's shotai, Okabe instead climbed to intercept VB-5's SBDs as they prepared to make their diving attacks from 17,000ft above *Shokaku*. He reached their altitude just as the last SBDs began their dives, following them down but finding it difficult not to overshoot. The shotai pilots had to maneuver to slow their aircraft down, which in turn reduced their opportunities for firing. Nevertheless, 2Lt John J. Powers' SBD was hit by 20mm

fire, setting it ablaze and wounding both the pilot and his gunner, but not preventing the dropping of their 500lb bomb, which hit *Shokaku* and started fires on the flightdeck and in the hangar deck.

As the SBDs pulled out of their dives and egressed at low level, Okabe continued to make dive-and-zoom attacks on them. Another SBD flown by Ens Davis E. Chaffee failed to return from the strike, having possibly been brought down by Okabe's shotai. The surviving Dauntless crews claimed seven Zero-sens shot down, although none were actually lost.

The last four SBDs to attack were from VS-2, led by *Lexington*'s Carrier Air Group Commander, Cdr Bill Ault, and they scored one hit too. The SBD of Ens John Wingfield, with a hung-up bomb, turned out of formation and headed back to *Shokaku* and was never seen again – he almost certainly fell victim to Zero-sens. As the remaining three SBDs formed up after their attack, they were set upon by an estimated 20 A6M2s and two of the Dauntlesses were shot down.

Lt(jg) William Hall (seen here after he was promoted to lieutenant commander later in the war) of VS-2 was badly wounded by *Zuikaku*'s Zero-sens on May 8, 1942 while flying his SBD as a makeshift fighter in defense of *Lexington*. Several fighters targeted Hall's Dauntless, which was hit in the cockpit by a 20mm shell. Nursing his dive-bomber back aboard *Lexington*, Hall was subsequently awarded the Medal of Honor for his actions that day. (NHHC)

Overall, SBD gunners claimed seven Zero-sens shot down during the attack on the carriers, although none were actually lost to Dauntlesses. *Shokaku* and *Zuikaku* fighter units claimed a total of 12 SBDs destroyed between them. Okabe was credited with six of these victories (three SBDs and three F4Fs), having claimed eight destroyed.

At 1055 hrs, *Lexington*'s radar detected Japanese aircraft at 68 miles out. In order to bolster fleet defense, it was decided to use the SBD as a low-level torpedo-bomber interceptor. Flying CAP were 17 F4Fs reinforced by 18 SBD-3s. Leading a formation of eight SBDs from VS-5, Lt Roger Woodhall set his formation at 2,000ft in anticipation of a low-level attack. They were 3,000ft short, as 18 B5N2 swept overhead straight towards *Yorktown*. They never fired a shot, and shortly after 18 escorting A6M2s pounced, despatching two SBDs. In return, VS-5 claimed four Zero-sens shot down, with Lt Stanley W. Vejtasa claiming the lion's share. The IJNAF recorded no fighters lost in this combat.

Lexington's low-level SBDs (15 in total) also tangled with Japanese aircraft when nine Dauntlesses of VS-2 found themselves in an excellent position to intercept incoming torpedo-bombers. With a slight height advantage, a number of SBDs were able to intercept a formation of B5N2s and four were claimed as shot down. In reality, just one was "splashed." Shortly thereafter, *Zuikaku*'s Zero-sen escort charged in, with several fighters targeting Lt William E. Hall's SBD. The aircraft was hit in the cockpit by a 20mm shell, which wounded the pilot in both ankles. Despite his right foot being nearly severed, Hall remained in the fight, twisting, turning and firing bursts whenever a Zero-sen came into his sights.

Seeing his plight, Ens John Leppla and his gunner, ARM2c John Liska, came to his aid. Hall (who subsequently received a Congressional Medal of Honor for his actions that day) and Leppla survived the attack, but both of their SBDs were heavily damaged. Leppla and Liska claimed four A6M2s during this mission.

Using Dauntlesses as makeshift fighters against torpedo-bombers had resulted in the loss of six SBDs (all to Zero-sens), with two more jettisoned due to battle damage.

SBD-2 BuNo 2106 of VMSB-241 sustained 219 bullet holes during the unit's ill-fated attack on *Akagi* on the morning of June 4, 1942. Pilot 2Lt Daniel Iverson and radioman-gunner PFC Wallace J. Reid were followed down in their attack dive by two Zero-sens, which were then joined by two more as the SBD headed for Midway Atoll. Rounds knocked out the hydraulic system and wounded Reid, while another bullet clipped Iverson's throat mike chord. Nevertheless, he was able to make a one-wheel landing on the atoll. This aircraft had served with VS-2, embarked in *Lexington*, from December 1940 to April 1942, when it joined VMSB-241. Repaired and returned to the US, the SBD ditched in Lake Michigan during a failed landing approach to the training carrier USS *Sable* (IX-81) on June 11, 1943. It was recovered in 1994 and restored, prior to being put on display in the National Naval Aviation Museum at NAS Pensacola, Florida, in 2001. (NHHC)

Dauntless pilots and gunners had claimed 19 aircraft destroyed, including ten Zero-sens. The actual victory tally was far less impressive, with only one D3A1 and five B5N2s falling to the SBDs.

While the Battle of the Coral Sea had been a tactical victory for the Japanese, it had been a strategic success for the Americans as they had prevented the seaborne invasion of Port Moresby. Despite this setback in the South Pacific, the IJN high command refused to be swayed from its main objective – the complete destruction of the US Navy's Pacific Fleet. To provoke the Americans into battle, the IJN chose to attack Midway Atoll in early June. The Japanese committed four fleet carriers – *Kaga, Akagi*, *Hiryu*, and *Soryu* – with 72 A6M2s on board. In response, the US Navy sent *Enterprise, Hornet*, and *Yorktown* to defend the strategic outpost. Between them, the vessels had 113 Dauntlesses (mostly SBD-3s) embarked. There were also 16 SBD-2s from VMSB-241 based on Midway itself, these aircraft having only arrived on May 26.

Shortly before 0600 hrs on June 4, the Battle of Midway commenced when the radar station sited on the atoll reported "Many planes, 89 miles, bearing 320 degrees." In response, VMSB-241 scrambled all 16 of its SBDs, along with 11 SB2U-3s. Just after 0700 hrs, lookouts on *Akagi* spotted the first wave of attackers, which consisted of six TBF Avengers and four B-26 Marauders. Flying CAP were 29 Zero-sens. Shortly after 0800 hrs, the 16 SBDs from VMSB-241, led by unit CO Maj Lofton Henderson, began their attack.

Because the unit's pilots had had little time and spare fuel for training on the SBDs, Henderson decided to use glide-bombing tactics rather than the steeper, more difficult, 70-degree dives for which the Douglas dive-bomber was intended. Unfortunately, this exposed his SBDs to longer periods of fighter attack. As they approached *Akagi*, they were met by nine Zero-sen CAP fighters at 8,000ft. Second division leader Capt Elmer Glidden later recalled:

> The first [enemy fighter] attacks were directed at the squadron leader in an attempt to put him out of action. After about two passes, one of the enemy put several shots through Maj Henderson's plane, and it started to burn. From the actions of the leader, it was apparent that he was hit and out of action. I was leader of the second box immediately behind the major. As soon as it was apparent that the major was out of action, I took over the lead and continued the attack. Fighter attacks were heavy, so I led the squadron down through a protecting layer of clouds and gave the signal to attack. On emerging from the cloud bank, the enemy carrier was directly below the squadron, and all the planes made their runs. The diving interval was about five seconds.
>
> Immediately after coming out from the protection of the clouds the squadron was attacked again by fighter planes and heavy anti-aircraft fire. After making my run, I kept heading for the water, and I flew on an approximate heading home.

Only near misses were recorded by VMSB-241, and six SBDs were shot down, including Maj Henderson, by fighters from *Akagi*, *Hiryu*, and *Soryu*. SBD gunners in turn claimed four Zero-sens destroyed, but only the aircraft of WO Yoshimi Kodama from *Hiryu* was lost.

US Navy carrier aircraft began launching at 0700 hrs, heading for the Japanese carriers. *Enterprise* and *Hornet* launched 67 SBDs, 29 TBD-1s and 20 F4Fs, with 17 SBDs, 12 TBD-1s, and six F4Fs departing from *Yorktown* shortly thereafter. The first to attack were *Hornet*'s 15 Devastators from VT-8, going in at wavetop height from 0915 hrs. The IJNAF had a number of A6M2s aloft from *Akagi*, *Kaga*, and *Soryu*, and they were vectored towards the incoming raid. *Akagi* and *Kaga* also quickly scrambled 11 more Zero-sens. Next into the attack were the 14 torpedo-bombers of VT-6 from *Enterprise*. The Devastator strike was a complete disaster, with 24 TBDs being shot down.

At 1010hrs the last TBDs, from VT-3 on board *Yorktown*, began their runs. The Zero-sen CAP now numbered 41, and most of the IJNAF fighters were at low altitude dealing with the multiple of torpedo-bomber attacks. As *Yorktown*'s TBDs made their runs, IJN lookouts failed to see the approach of the SBDs from VB-3 at 15,000ft. They were followed by 32 SBDs from VS-6 and VB-6. With no CAP present and no anti-aircraft fire to speak of, the Dauntlesses hit *Kaga, Akagi*, and *Soryu* in quick succession. The attack was over in a matter of minutes.

Having pulled off their targets, the SBDs from *Enterprise* quickly ran into a swarm of Zero-sens. The carrier's air group commander, Lt Cdr Wade McClusky, found himself under attack by two A6M2s. Staying just 20ft above the water, former fighter pilot McClusky and his gunner, ARM2c Walter G. Chocalousek, battled with the two Zero-sens until one of them got in a solid burst, hitting McClusky in the shoulder. Either low on ammunition or fuel, the Zero-sens then broke off their attack. With a bullet in his shoulder, his SBD holed 55 times by machine gun rounds and its tail damaged when Chocalousek unsuccessfully tried to fire his guns either side of it, McClusky managed to land on board *Enterprise* with just five gallons of fuel remaining. In all, 16 of McClusky's 32 SBDs failed to return. Two were shot down by fighters or anti-aircraft fire, and the rest ditched due to lack of fuel. One Zero-sen was claimed shot down.

One IJN carrier remained, *Hiryu.* On board *Enterprise*, 25 SBDs were available, including 14 from VB-3 (whose aircraft had been forced to land on the carrier after *Yorktown* suffered mortal damage at the hands of the IJNAF), seven from VS-6 and four from VB-6. The strike was launched at 1530 hrs. Thirty minutes later, *Hornet* added another 16 SBDs. *Enterprise*'s strike group, led by Lt Wilmer Gallaher, once again

SBD-3 BuNo 4542 was also damaged by Zero-sens on June 4, 1942, the Dauntless from VB-6 being photographed taxiing forward on *Yorktown*'s flightdeck after recovering from the spectacularly successful morning strike on the IJN fleet. Ens George H. Goldsmith and his radioman-gunner ARM2c James W. Patterson lacked fuel to reach *Enterprise*, and they barely made it back aboard *Lexington*. The aircraft, which had been attacked by A6M2s after targeting *Kaga*, was subsequently lost when *Yorktown* sank on June 7. (NHHC)

surprised the Japanese. Aloft were 13 Zero-sens, but their disposition and altitude is unknown. At 1705 hrs the attack began. The defending fighters eventually caught the SBDs in their dives and bravely pursued them down into their own flak barrage. A single VB-6 SBD was shot down, followed by two more from VB-3 during their low-level escape. Four 500lb bombs found their mark, turning *Hiryu* into a flaming wreck.

The US Navy had won a tremendous victory. In return for four IJN carriers sunk, the six US Navy SBD squadrons and VMSB-241 had lost some 35 aircraft and about 40 crew – many of them to Zero-sens. In exchange, SBD crews probably shot down just two A6M2s.

The Douglas dive-bomber next fell prey to the Zero-sen on July 29, when eight Banshees from the 8th BS/3rd BG attempted to attack a five-ship convoy of Japanese transports and their escorts off Gona, on the northeast coast of New Guinea. As the A-24s pushed over into their dives, a nine-strong chutai of A6M2s led by Lt Joji Yamashita from Tainan Kokutai went after them. The first Banshee lost was the aircraft flown by unit CO, Maj Floyd Rogers, the dive-bomber crashing into the sea. Lt John Hill's aircraft was also hit, mortally wounding rear gunner Sgt Ralph Sam. Hill managed to nurse his Banshee back to the newly completed airfield at Milne Bay. Another A-24 was downed by anti-aircraft fire and crews from three more dive-bombers were either forced to crash land or bail out. The Banshee was subsequently removed from frontline service by the USAAF with immediate effect.

The victory at Midway had allowed the US Navy to take a more offensive stance. In order to press the initiative, the Americans quickly set their sights on the Japanese airfield being constructed on Guadalcanal. On August 7, the 1st Marine Division landed nearby, encountering only minimal resistance. In support were the carriers *Enterprise*, *Saratoga*, and USS *Wasp* (CV-7). Reacting quickly, Rabaul-based bombers and fighters of the IJNAF's 11th Koku Kantai attacked the invasion fleet. Damage was minimal, but it did result in the war's most famous air-to-air battle between SBDs and Zero-sens. As F4Fs tore into the Japanese formations, a single SBD from *Wasp*, flown by Lt Dudley Adams of VS-71, managed to surprise four Zero-sens from above and behind. After scoring hits on the lead fighter, Adams quickly broke off and headed for cloud cover.

Unfortunately for Adams, the Zero-sen he struck was flown by Tainan Kokutai ace FPO1c Saburo Sakai, who recounted the experience in his memoir *Samurai!*:

> We flew through broken clouds, unable to find any hostile planes. No sooner had we emerged from one cloud than, for the first time in all my years of combat, an enemy plane caught me unawares. I felt a heavy thud, the scream of a bullet, and a hole two inches across appeared through the cockpit glass to my left, only inches away from my face.

NCO pilots from Tainan Kokutai's 2nd Chutai come together for a group photograph at Rabaul in June 1942. In the front row, from left to right, are (with IJNAF credited victories in brackets) FP03cs Yoshimi Onishi, Seiji Ishikawa (5 victories), and Kenichi Kumagaya (2 victories), Sea1c Suehiro Yamamoto and FP03c Hiroshi Okano. In the second row, from left to right, are FP02c Toshio Ota (34 victories), FP01c Saburo Sakai (60+ victories), Sea1c Masayoshi Yonekawa (6 victories), and FP03c Unichi Miya. Standing, from left to right, are FP01c Hiroyoshi Nishizawa (86 victories), FP03cs Daizo Fukumori, Yutaka Kimura and Masuaki Endo (14 victories), P01c Katsumi Kobayashi, and P03c Takeichi Kokubun. (Tony Holmes Collection)

I still had not seen any other planes in the air. It might have been ground fire which hit me. Then I caught a glimpse of an enemy bomber – not a fighter! – which had caught me napping. The Dauntless hung on its wing, racing for cloud cover. The audacity of the enemy pilot was amazing; he had deliberately jumped four Zero fighters in a slow and lightly armed dive-bomber.

In a moment I was on his tail. The Dauntless jerked up and down several times, then dove suddenly into a cloud. I wasn't giving up that easily; I went right after him. For a few seconds I saw only white as we raced through the billowing mass. Then we were through, in the clear. I closed in rapidly and fired. The rear gunner flung up his hands and collapsed over his gun. I pulled back easily on the stick and the shells walked up to the engine. The SBD rolled repeatedly to the left, then dropped into a wild dive. [FPO2c Masayoshi] Yonekawa saw the pilot bail out. It was my 60th victory.

A few minutes later, while flying at 13,000ft over the coast of Guadalcanal, Sakai spotted a formation of what he believed were eight F4Fs. They were in fact SBDs from VB-6 and VS-5 led by Lt Carl Horenburger, the aircraft circling over Tulagi awaiting orders to attack a target. As Sakai and his wingman closed the range, the SBD rear gunners opened fire. For the high-scoring ace, it was his most memorable and harrowing combat of the war:

I was in a trap! The enemy planes were not fighters, but bombers, the Avenger [they were SBDs] torpedo planes, types I had never seen before. From the rear, they looked exactly like Wildcats, but now their extra size was visible.

There was no turning back now. If I turned or looped, the enemy gunners would have a clear shot at the exposed belly of the Zero. There was only one thing to do – keep going, and open up with everything I had. I jammed down on the firing button. Almost at the same moment every gun in the Avenger formation opened up. The planes were only 20 yards in front of me when flames spurted from two bombers. That was all I saw. A violent explosion smashed at my body. I felt as though knives had been thrust savagely into my ears; the world burst into flaming red and I went blind.

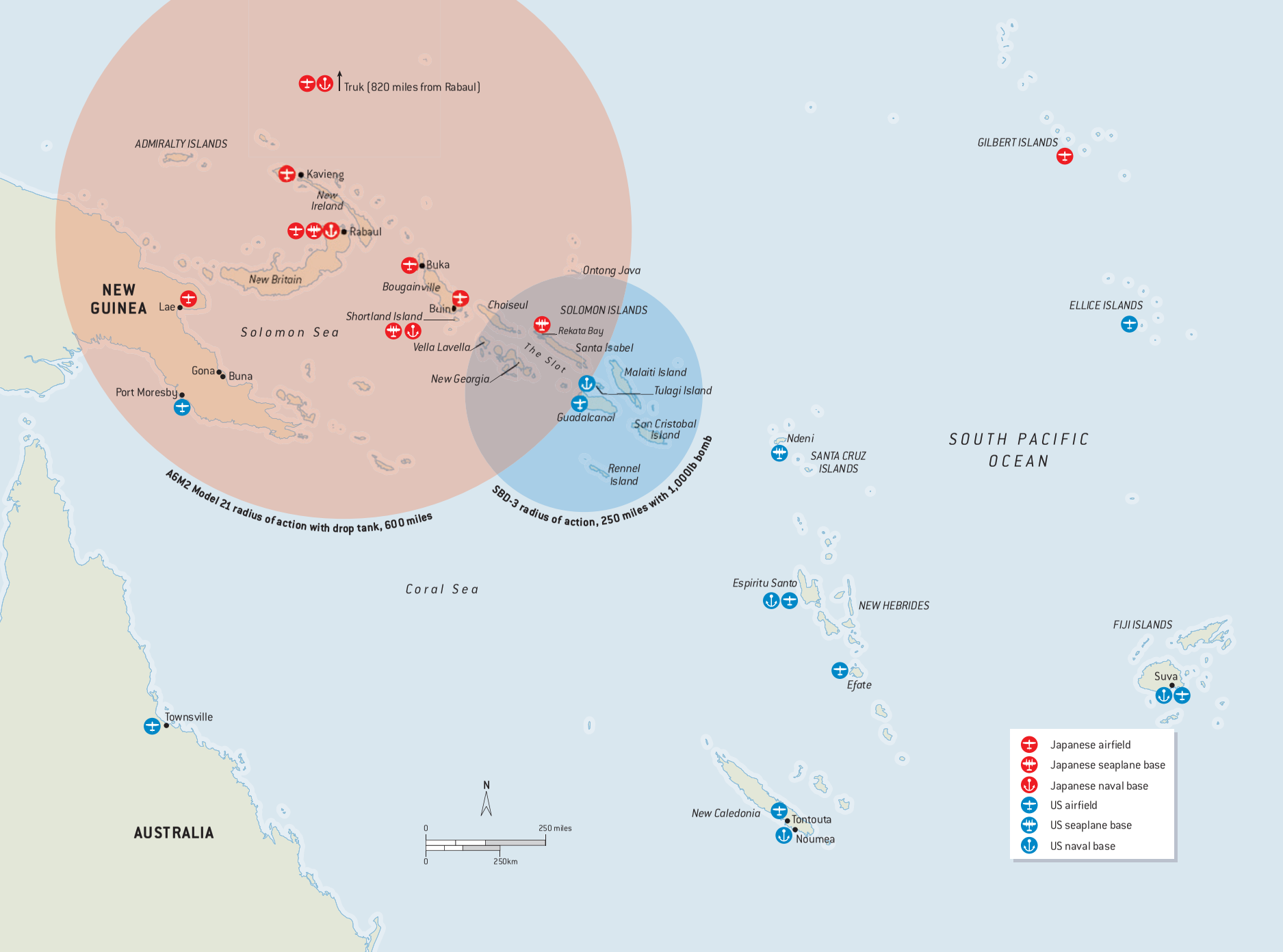
Severely wounded after his cockpit had been struck by multiple 0.30-cal. hits, Sakai dropped from 8,000ft to almost sea level, before pulling out. In one of the epic flights of the war, he nursed his crippled fighter back more than 550 miles to Rabaul. Sakai would spend 18 months in hospital recovering from his clash with the SBDs.

On August 20, 12 SBDs of VMSB-232 and a similar number of F4Fs from VMF-223 landed on Guadalcanal. The job of the newly arrived SBDs was straightforward. Attack all in-bound enemy convoys. It did not take long for the Japanese to respond to the seizing of Guadalcanal – a large convoy of ships loaded with troops and supplies set sail from Truk. In support would be the carriers *Shokaku, Zuikaku*, and *Ryujo*. The US Navy in turn despatched *Saratoga* and *Enterprise* to defend Guadalcanal. On August 23 the Japanese convoy was spotted, and the following day the light carrier *Ryujo* was sighted.

At 1340 hrs on the 24th, 30 SBDs of VS-6 and VB-6 from *Enterprise*, led by Cdr Harry D. Felt, were sent to hit the carrier. This action signaled the start of what would become known as the Battle of the Eastern Solomons. IJNAF fighter opposition was minimal (one A6M2 fell to ARM3c J. V. Godfrey of VB-3, the victory being confirmed by his pilot, Ens

OVERLEAF

On August 7, 1942, high-scoring ace FP01c Saburo Sakai led A6M2s from Tainan Kokutai into action over Guadalcanal for the first time. Once in the target area, Sakai downed an F4F and an "aggressive" SBD flown by Lt Dudley Adams of VS-71. After despatching the Dauntless, he spotted what he believed to be eight F4Fs in formation. The latter was in fact Flight 319 from *Enterprise*, consisting of six SBD-3s from VB-6 and two from VS-5, led by Lt Carl Horenburger. Flying at an altitude of 8,500ft off Tulagi, they were awaiting target instructions when, suddenly, Horenburger's rear gunner, ARM2c Herman Caruthers, called out, "Fighters!" The order to tighten the formation was given as Horenburger led his charges into a gradual turn to starboard, heading for the nearest cumulus cloud. Sakai and his wingman, PO2c Enji Kakimoto, quickly closed the distance. Diving from above and astern, Sakai moved into range and opened fire. The three gunners in Horenburger's section returned fire, including ARM2c Harold L. Jones from VB-6, who recalled, "As the Zero coming directly in from astern was about 500ft away, he started shooting. Some gunners, including myself, could not bring our guns to bear on him without damaging our tails, but as the Zero turned to the right and pulled up to miss us, every gunner was shooting at him – he could have been only 100ft away! His cockpit exploded, the canopy tore and something flew out. I could see his face clearly, his body and head forced back against the headrest of the cockpit." Although Sakai put 232 holes in Jones' SBD, the radioman-gunner had also hit the cockpit of the Zero-sen. Severely wounded in the head, the IJNAF ace dropped nearly 8,000ft before leveling out at sea level and nursing his crippled fighter more than 550 miles back to Rabaul.


Truk (820 miles from Rabaul)
ADMIRALTY ISLANDS
Kavieng
New Ireland
Rabaul
Buka
New Britain
Bougainville
NEW GUINEA
Lae
Buin
Shortland Island
Solomon Sea
Vella Lavella
Choiseul
SOLOMON ISLANDS
Rekata Bay
Ontong Java
Santa Isabel
The Slot
New Georgia
Malaiti Island
Tulagi Island
Guadalcanal
San Cristobal Island
Rennel Island
Gona
Buna
Port Moresby
A6M2 Model 21 radius of action with drop tank, 600 miles
SBD-3 radius of action, 250 miles with 1,000lb bomb
Coral Sea
AUSTRALIA
Townsville
GILBERT ISLANDS
ELLICE ISLANDS
Ndeni
SANTA CRUZ ISLANDS
SOUTH PACIFIC OCEAN
Espiritu Santo
NEW HEBRIDES
Efate
FIJI ISLANDS
Suva
New Caledonia
Tontouta
Noumea
N
0
250 miles
0
250km
Japanese airfield
Japanese seaplane base
Japanese naval base
US airfield
US seaplane base
US naval base

A. W. Hanson), with the SBDs scoring three 1,000lb bomb hits and a TBF striking the doomed carrier with a torpedo. On August 25, eight SBDs from Guadalcanal found the convoy, and with no fighter opposition to worry about, they hit the light cruiser *Jintsu* and the transport *Kinryu Maru*. This forced the convoy north, out of SBD range.

The first Japanese operation to retake the island ended in complete failure. The existence of the hastily formed "Cactus Air Force" (consisting of aircraft from the USAAF, US Navy, and US Marine Corps, and the Royal New Zealand Air Force), and its small number of SBDs, severely hampered Japanese planning and IJN operations around Guadalcanal. The SBDs now dictated events up to 200 miles from Henderson Field, forcing the IJN to run fast destroyer convoys at night.

For the coming weeks and months, the daily grind of constant patrols and attacks would wear on the SBD crews. Fortunately for them fighter opposition was infrequent. Lt Col Richard C. Mangrum, CO of VMSB-232 recalled:

> We thought it would be nice to have fighter escort when we sent somewhere, but the essential task of our fighters was to protect the beachhead from attack, and they were superb at the job. Conversely, the primary task of Japanese fighters was to protect their bombers, and Guadalcanal was then at about the maximum radius of action. Thus, they had no time to get after us, and we could usually keep out of their way.

When fighter opposition did appear, SBD pilots quickly learned that cloud cover and tight formations offered the best protection. Mangrum explained:

> Cloud cover was utilized effectively to avoid both anti-aircraft fire and aircraft attacks. Without the presence of this cloud coverage our losses would undoubtedly have been heavy. Concentrated formations providing maximum gun fire from the twin-mount free guns were used effectively. The enemy was reluctant to close the range under these conditions. Stragglers were easy victims for the enemy.

OPPOSITE

For the first two months of the Guadalcanal battle, IJNAF Zero-sen pilots had to fly the 1,120-mile round trip from their airfield at Rabaul to Guadalcanal. This gave them little combat time over Guadalcanal and the surrounding areas. SBD pilots, however, had more than adequate range to interdict Japanese supply convoys coming down "The Slot" on their way to Guadalcanal. Even though only a small number of Dauntlesses operated from Henderson Field during this period, SBD crews played a key role in both the defensive and offensive aspects of the Guadalcanal campaign.

This SBD-3 of the "Cactus Air Force," fully armed with a 500lb bomb on the centerline and two 100lb weapons beneath the wings, receives last-minute attention from shirtless groundcrew at Henderson Field during fall 1942. Its assigned unit is impossible to determine, partly because SBD crews often flew other squadrons' aircraft, depending upon availability. (NHHC)

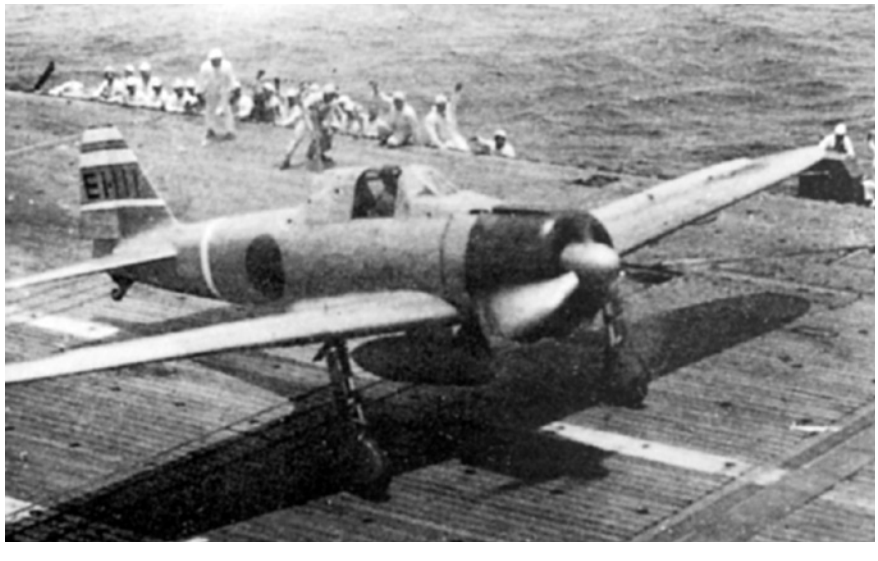
A VS-10 SBD-3 flies overhead *Enterprise* as it joins the carrier's recovery pattern in October 1942. This particular aircraft played an important part in the Battle of the Santa Cruz Islands on October 26 when it was one of two Dauntlesses that successfully attacked the light carrier *Zuiho*. Pulling out from their dives, the SBDs were met by three Zero-sens from *Zuikaku*. Weaving back and forth, pilots Lt Stockton Strong (in this aircraft) and Ens Charles Irvine stayed tight as the rear gunners returned fire. Following a 45-minute running fight, the A6M2s broke off after SEA1c Koichi Nakagami had been shot down. (NHHC)

On October 26 the IJN and IJA launched a new combined offensive, with massive support from 11th Koku Kantai at Rabaul. The Japanese committed the fleet carriers *Shokaku, Zuikaku*, and the light carriers *Junyo* and *Zuiho*, while the Americans countered with *Enterprise* and *Hornet*, which had 47 SBD-3s embarked between them.

The first to draw blood in what became known as the Battle of the Santa Cruz Islands were two search SBDs from VS-10, embarked in *Enterprise*. At 0740 hrs Lt Stockton Strong and Ens Charles Irvine attacked *Zuiho* without being detected, hitting the carrier with two 500lb bombs. Pulling out from their dives, they were met by three Zero-sens from *Zuikaku*. Weaving back and forth, the two SBDs stayed tight as the rear gunners returned fire. After a 45-minute running fight, the A6M2s broke off, leaving the two SBDs damaged, with a claim of two fighters shot down – the aircraft of SEA1c Koichi Nakagami was in fact the only Zero-sen destroyed. All 16 of *Enterprise*'s search SBDs made it back, where crews claimed one carrier heavily damaged and seven Zero-sens and one "Kate" shot down. The true score was one Zero-sen shot down (Nakagami's A6M2).

The next IJN carrier to be hit was *Shokaku*. At 0915 hrs, *Hornet*'s first attack group of 15 SBDs, led by VS-8 CO Lt Cdr William "Gus" Widhelm, was intercepted by the Japanese CAP. VB-8's Lt J. M. "Moe" Vose later recalled:

> Gus Widhelm and I joined our squadrons, passed directly over the Japanese cruiser group and continued on, all the while under Zero attack [by A6M2s from *Shokaku* and *Zuiho*]. Gus was hit in sight of the carriers [shortly after downing the Zero-sen of FCPO Shigetaka Ohmori in a head-on pass], and landed in the middle of the disposition – he and his gunner, ARM1c George Stockley, were later rescued.



Lt Hideki Shingo departs *Shokaku* on October 26, 1942 as part of the second wave attack on *Enterprise* and *Hornet* during the Battle of the Santa Cruz Islands – pilots in this wave claimed five US Navy aircraft shot down. Shingo was the squadron leader of the carrier's embarked A6M2 fighter force, and he had previously seen combat in China in the late 1930s and during the early months of the Pacific War. (Tony Holmes Collection)

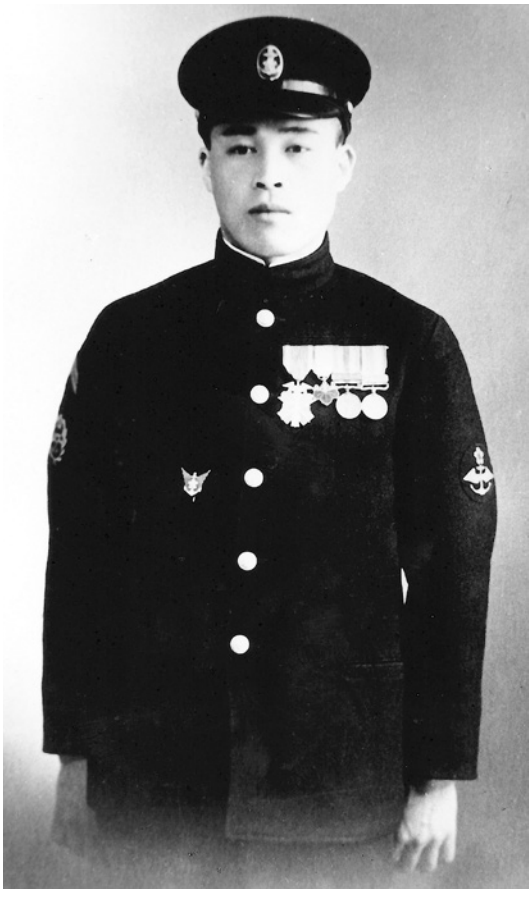
I was first to dive. Widhelm's people had joined on mine, and I saw three hits on *Shokaku*. As we pulled out we were taking evasive action at wavetop level, under continued Zero attack.

Attacking from above, ahead and the sides, the carrier CAP not only downed Widhelm's SBD but also a second dive-bomber, and damaged two more so severely they had to turn back. However, as Vose explained, the remaining 11 Dauntlesses scored four hits on *Shokaku.* He then led his unit back to *Enterprise*, as *Hornet* had sustained mortal damage during a well-executed attack by IJNAF "Kates" and "Vals." Although the Battle of the Santa Cruz Islands had again been a tactical defeat for the US Navy, it had prevented the Japanese from reinforcing Guadalcanal. *Hornet* had been sunk and 74 aircraft destroyed, including 31 SBDs to all causes. Of that number, four Dauntlesses were shot down by Zero-sens. In return, SBDs crews claimed 23 A6M2s shot down. The actual number was closer to three.

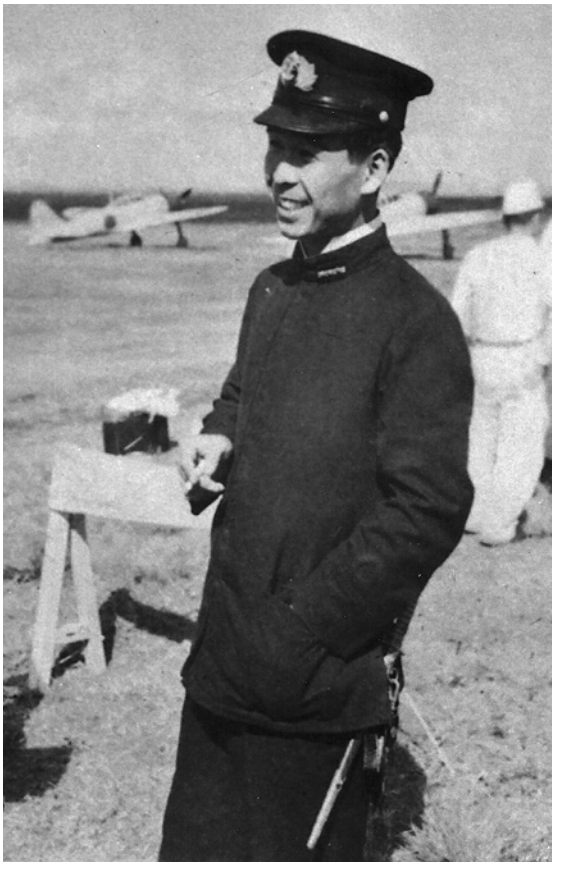
Unable to exploit the victory off the Santa Cruz Islands, the Japanese Imperial General Headquarters could not afford another major defeat after suffering heavy losses in men and aircraft, if not actually in ships. For the first time, both the IJA and the IJN agreed to cooperate on a combined operation to finally win the battle for Guadalcanal. The plan called for 11 transports of the IJA's 2nd Ship Group, crammed with troops and escorted by 12 destroyers, to run down "The Slot" (New Georgia Sound), with top cover provided by Zero-sens of 11th Koku Kantai and from the light carrier *Hiyo*. On November 14 the convoy set sail, and it was targeted by 23 SBDs from the "Cactus Air Force" and 31 Dauntlesses from VS-10 and VB-10, embarked in *Enterprise*. At 0700 hrs the convoy was spotted 150 miles from Guadalcanal. This was quickly followed by an attack by two SBDs from VS-10. One Dauntless was lost and a Zero-sen was claimed by the rear gunners, but none were in fact downed.

At 1250 hrs, the first large strike of the day was launched from Henderson Field, with 19 SBDs from VMSB-132, VMSB-142, and VB-10, escorted by fighters, hitting the convoy. Two transports were sunk and two Zero-sens shot down by VMSB-142, with two more fighters "left smoking" by VMSB-132. The pattern was now set for the rest of the day. As the transports doggedly ran the gauntlet, the SBDs were refueled and rearmed as quickly as possible. At any one time the Zero-sen CAP over the convoy consisted of just six to 12 aircraft – too few to have any impact on the attacking SBDs. At 1430 hrs, three Dauntlesses from VS-10 and two from VMSB-132 hit two transports, and 20 minutes later, with no IJNAF CAP available, eight more SBDs from VS-10 arrived and claimed a further three strikes on Japanese vessels.

At 1530 hrs eight SBDs from *Enterprise* arrived over "The Slot," where they encountered the stiffest aerial opposition of the day from four Zero-sens of 582nd



FCPO Shigetaka Ohmori was a shotaicho on *Akagi* who flew several sorties at Midway and claimed eight US Navy aircraft shot down before finally ditching his Zero-sen when his own carrier and *Hiryu* were ablaze. During the Battle of the Santa Cruz Islands, whilst flying from *Shokaku*, he made repeated head-on diving attacks against SBDs of VS-8 from *Hornet* that were threatening his carrier. When Ohmori's oncoming Zero-sen was fatally damaged by formation leader Lt Cdr W J Widhelm, the IJNAF ace attempted to ram the SBD and was credited with its destruction (taking his final tally to 13 victories). Ohmori, who perished, was posthumously promoted two ranks to ensign. (Tony Holmes Collection)



Veteran fighter pilot and eight-victory ace Lt Cdr Tadashi Kaneko was killed in action on November 14, 1942 when he was shot down by SBD-3 radioman-gunner ARM2c G. C. Gardner of VB-10 whilst leading a land-based fighter detachment from the carrier *Hiyo* on convoy escort duty from Buin, on Bougainville. Having claimed his first victories in China in August 1937, Kaneko had participated in the Pearl Harbor attack, added to his tally of aerial successes over Ceylon in April 1942 and then seen further action over New Guinea and during the Battle of Midway. Kaneko had claimed three F4Fs destroyed just 72 hours prior to his death. (Tony Holmes Collection)

Kokutai. Several SBDs were heavily damaged and, in return, US Navy dive-bomber crews were credited with three Zero-sens shot down, although no A6M2s were actually lost during this attack. At 1600 hrs the Zero-sen CAP would have its best showing. As Lt Cdr "Tommy" Thomas, CO of VB-10, led seven SBDs toward the convoy, they found themselves still climbing up to attack altitude and bereft of F4F fighter cover. Slow and vulnerable, the Dauntlesses were set upon by six Zero-sens from *Hiyo*.

The IJNAF fighters, commanded by air group leader Lt Cdr Tadashi Kaneko, destroyed three SBDs and badly damaged two more – the aircraft flown by Lt(jg) Len Robinson landed at Henderson Field perforated by 68 shell holes. In exchange, SBDs shot down three Zero-sens (including Kaneko's), one of which fell to Robinson after the fighter was hit in a head-on attack. It was the heaviest loss of the day for the "Cactus Air Force." The last strike mounted on the 14th was a mixed attack by US Marine Corps and US Navy SBDs and TBF Avengers, escorted by F4F Wildcats. The aircraft achieved one hit on *Nako Maru*, leaving the Japanese with just four transports and five destroyers.

The operational tempo of the SBDs of the "Cactus Air Force" and from *Enterprise* was at its highest during the entire Guadalcanal campaign on November 14. By the time night fell, the US Navy had lost five SBDs from *Enterprise*, with a further 16 badly damaged. Nine Zero-sens had been shot down, three falling to SBDs and six to F4Fs. The failure of the November convoy was the decisive turning point in the fight for control of Guadalcanal. The presence of Dauntlesses on the island, and the contribution they duly made to its dogged defense, cannot be overstated. For the second time the SBD had had a direct impact on the course of the Pacific War.

With Japan's defeat at Guadalcanal, Dauntless crews encountered far fewer Zero-sens during the course of 1943. In October close to 100 ground-based US Navy and US Marine Corps Dauntlesses flying from Munda, on New Georgia, began offensive operations against the Japanese naval base at Rabaul. These daily strikes were heavily escorted, leaving the SBDs free of fighter attack. Two carrier strikes were launched against Rabaul in support of the operation on November 5 and 11.

The year's combat ended for the fast carriers with an attack on Kwajalein Atoll, in the Marshall Islands, on December 4. Carrier Air Group 16, embarked in USS *Lexington* (CV-16), encountered stiff aerial opposition from A6Ms of 252nd and 281st Kokutais and 1st Air Flotilla over and around Roi Island. Although the bulk of the 27 victories credited to the carrier air group that day fell to F6F Hellcat-equipped VF-16, the SBD-5s of VB-16 claimed 7.5 kills – six of them "Zekes" – in one of the most successful air-to-air actions ever recorded by a Dauntless squadron. VB-9, flying from *Essex* during the Kwajalein Atoll strike, was also credited with a "Hamp"

A6M2s from an unidentified kokutai assigned to 11th Koku Kantai taxi out en masse at an airfield near Rabaul at the start of another long-range mission to Guadalcanal in the fall of 1942. All of the aircraft are equipped with mandatory 72-gallon drop tanks that greatly extended the Zero-sen's already unmatched range. (Edward M. Young Collection)

destroyed. These victories took claims for carrier-based SBD crews in 1943 to 13 kills in total, for the loss of just two aircraft.

In the last great carrier clash of the war, SBDs would once again play their part. On June 19–20, 1944, during the Battle of the Philippine Sea, the seven fast carriers and eight light carriers of the US Navy's TF 58 set out to destroy the IJN's First Mobile Force, consisting of five fleet carriers and four light carriers, off the Marianas Islands. By then, VB-10, embarked in *Enterprise*, and VB-16, embarked in *Lexington*, were the last two SBD units afloat.

At 1630 hrs on June 20, 25 SBD-5s were launched. At 1754 hrs the IJN spotted the incoming raid and launched 40 A6M5s and 29 older A6M2s. The first to strike were the SBDs from VB-10. As they prepared to dive on the Japanese carrier *Junyo*, they were attacked by up to eight Zero-sens. Firing at long range, the Japanese fighters showed little aggression and had no effect. As the SBDs pulled off their target, they were met by a number of Zero-sens, but no SBDs were lost. Next to bomb were the 11 aircraft from VB-16. Their target was the carrier *Hiyo*. As the SBDs withdrew, eight Zero-sens pressed home their attacks and the aircraft of Lt(jg) J A Shields and ARM2c L. O. LeMay was shot down. In reply, VB-16 gunners claimed two "Zekes" destroyed and 13 damaged. This was the last air-to-air combat between the SBD and the Zero-sen.

SBD-5s of VB-16 are manned by their crews on *Lexington*'s flightdeck prior to attacking the Gilbert Islands on September 18, 1943. Although no Zero-sens were encountered on this mission, between December 4, 1943 and June 20, 1944, VB-16 was credited with downing 10.5 aircraft, eight of them "Zekes." It claimed two more as probables and 12 damaged. (NHHC)

STATISTICS AND ANALYSIS

The Dauntless holds a unique place in naval aviation combat history. Its success was attributed to a number of variables not found with other bombers of World War II. Its loss rate was the lowest of all US Navy aircraft in the Pacific War. SBD crews were officially credited with an astonishing 138 aerial victories, 106 of them Zero-sens. Of the latter figure, 88 were shot down in 1942, 13 in 1943, and five in 1944. Although the vast majority of these successes were credited to US Navy units, land-based US Marine Corps SBD squadrons were officially credited with 30 victories over Guadalcanal and during the Battle of Midway in 1942 (again, these were mostly Zero-sens), and a further 11 in the central and upper Solomons battles of 1943–44. These are incredible totals, but they suffer greatly from overclaiming.

The extensive research by highly respected Pacific War historians John Lundstrom, James Sawruk, and Richard Frank has shown that the actual number of Zero-sens shot down by SBD crews was between five and nine in the first year of the war. During 1942, IJN carrier air groups lost 57 Zero-sens in aerial combat. From August 7 to November 15, 1942, land-based 11th Koku Kantai lost 72 Zero-sens in aerial combat during the Guadalcanal campaign. For US Navy and US Marine Corps SBDs to have destroyed 88 fighters in 1942 is unrealistic. That would leave just 42 Zero-sens destroyed by F4Fs for a loss off 111 Wildcats.

All bombers in World War II were vulnerable to fighter attack, no matter how many machine guns were fitted. This meant they all needed fighter escorts to survive. The SBD was no different. Even though it had reasonable armament, armor plate, and

Lt(jg) John A. Leppla (right) shakes hands with radioman-gunner ARM2c John A. Liska in front of an SBD at NAS North Island, in San Diego, on July 6, 1942. During the Battle of the Coral Sea they were pilot and gunner of an SBD-3 from VS-2 embarked in *Lexington*, and they were credited with shooting down seven IJNAF aircraft (six of them Zero-sens) on May 7–8, 1942. Leppla, as the leading SBD pilot in respect to aerial victories, made the transition to F4Fs and was killed during the Battle of the Santa Cruz Islands on October 26, 1942 shortly after downing another Zero-sen for his fifth victory. Liska became the leading SBD radioman-gunner when he also claimed a Zero-sen with VS-10 on October 26. (NHHC)

self-sealing fuel tanks, and squadrons implemented good formation tactics, it was still vulnerable to determined fighter attacks.

The high number of air-to-air victories attributed to SBD crews is a clear case of over-claiming. IJNAF Zero-sen pilots were just as guilty, and the reasons were many and the same. For the most part, air-to-air combat was fleeting and confusing, lasting minutes, with just a few seconds' firing time at an enemy aircraft. In some cases, however, SBDs fought low-level running battles with Zero-sens lasting more than 20 minutes. In that time, it was not unusual for more than one pilot or radioman-gunner to shoot at the same aircraft, both making a claim. In many cases, pilots and radioman-gunners saw what they wanted to see. The Zero-sen's lack of armor and self-sealing fuel tanks often meant that a flash of flame or trail of smoke was considered a victory. Many Zero-sens that were seen to "explode in flames" survived, only to have the flames extinguished at a lower altitude.

Gun camera film was virtually non-existent, and when it was available, the results were not always as definitive as one would hope. Atmospheric conditions also played their part, as the humid weather over Guadalcanal often meant a tight-turning aircraft produced vapor trails that could be easily confused for smoke.

Aircraft recognition was another problem. Like their American counterparts, IJNAF carrier-based aircraft were powered by radial engines. A number of times, SBD crews mistook Zero-sens for B5N2s or D3A1s. In an extreme case of misidentification, US Navy pilots reported seeing "Me 109s" during the Battle of Midway. One Naval Aviator from VB-3 stated:

> Enemy evidently had large force of fighters on patrol. They were apparently two types, the "0" type fighter and probably the Messerschmidt 109. Fighter at the top of my dive could not shoot me. I spiraled all the way down. The ones on pull out, believed to be inline engine types, made sweeping runs. I sustained two hits by them.

US Navy and US Marine Corps victory credits depended heavily on the honor system at unit level, which of course was open to abuse. Eyewitness accounts were also problematic, and during the Guadalcanal campaign the shortage of paper meant records had to be constructed or reconstructed partly from memory. Aircraft wrecks for verification were also non-existent, as the open ocean or impenetrable rain forest simply swallowed them up.

Victory claims by SBD crews were almost evenly divided between pilots and radioman-gunners. For Dauntless pilots, the number of Zero-sens they *actually* shot down was small. There were a number of reasons for this. A Zero-sen usually only presented itself as a target either during a head-on pass, or if the SBD pilot was lucky enough to "bounce" one from behind. The dive-bomber did not have the speed to go chasing after an attacking Zero-sen. When a pilot did get a Zero-sen in his gunsight, he was usually hampered by faulty equipment. Evidence of this is provided here in VS-2's Report of Action following clashes with IJNAF aircraft on May 7, 1942 during the Battle of the Coral Sea:

> The present telescopic sight has proved totally unsatisfactory. It fogs up when diving from high altitude due to the sudden change of temperature and consequent condensation on the lenses. The telescopic sight is, further, totally unsatisfactory for fixed gunnery as is fired in action today. Combat occurs at such low altitudes and vision is so restricted when looking through the sight it is seldom used in attacking enemy planes.

In the Guadalcanal campaign, SBD crews would be further handicapped by horrid living conditions and deficient training. When VMSB-132 arrived on Guadalcanal on October 30, 1942, the level of training completed by its crews was subpar, as 2Lt John McEniry remembers:

> None of us had ever fired the machine guns on the SBD. None of us had ever dropped a live bomb. None of us had ever flown the plane at night. None of us had ever flown the plane on instruments.

Combat fatigue, poor food, disease, and constant air operations drained the strength and ability of crews to perform their missions with accuracy and determination. The conditions for the Japanese pilots were no different, and as the battle dragged on their combat abilities suffered as well.

Officially, the highest scoring SBD crew was Lt(jg) John Leppla and his radioman-gunner, ARM3c John Liska, with seven claims (four by the pilot) during the Battle of the Coral Sea. While impressive, it is another example of overclaiming. No Zero-sens were actually shot down by SBDs during the battle. In this context, the credits for SBD crews listed here should be viewed in the same light:

Leading US Navy/US Marine Corps SBD Pilots		
Lt(jg) John A. Leppla	VS-2	4 (Zero-sens)
Lt(jg) William E. Hall	VS-2	3 (all B5N2s)
Lt(jg) Stanley W. Vejtasa	VS-5	3 (Zero-sens)
Lt Cook Cleland	VB-16	2 (Zero-sens)
Lt(jg) William E. Johnson	VS-10	2 (Zero-sens)
1Lt John McGuckin	VMSB-132	2 (Zero-sens)
Ens Richard F. Neely	VS-2	2 (1 Zero-sen and 1 B5N2)
Lt Chester V. Zalewski	VS-71	2 (1 Zero-sen and 1 E13A)

Leading US Navy/US Marine Corps SBD Radioman-Gunners		
ARM2c John Liska	VS-2 and VS-10	4 (Zero-sens)
Sgt Wallace Read	VMSB-231	3 (Zero-sens)
Sgt Virgil S. Bryd	VMSB-231	2 (Zero-sens)
ARM2c Wayne C. Colley	VS-10	2 (Zero-sens)

Thirteen US Marine Corps SBD squadrons were credited with 44 enemy aircraft shot down, the bulk of them coming during the Guadalcanal campaign. Of these claims, 35 went to gunners, six to pilots, and three were shared.

For Zero-sen pilots, shooting down an SBD proved a difficult task. Time and again, heavily damaged SBDs that they claimed as destroyed made it back to their carrier or to Henderson Field. The reasons for this were outlined in the following VB-5 Report of Action from May 8, 1942 – the second day of fighting in the Battle of the Coral Sea:

> The leak-proof tanks were very effective. As many as 14 holes were found in one tank and nine planes had one or more punctured tanks. Of these, only one caught fire or leaked. The armored seat of at least one plane is known to have stopped enemy bullets and the rear gun armor effectively stopped many bullets. It is also thought that the armored seat of one plane stopped or exploded a 20mm projectile.

At least 63 SBDs were lost to enemy fighters, the vast majority of those – 39 (official count) – being carrier-based in 1941–42. The remaining 24 were either downed in air combat during the Guadalcanal campaign or in the Battle of the Philippine Sea in June 1944. Unfortunately, although a number of IJNAF aces fought in the major carrier engagements of 1941–42 and during the fighting for Guadalcanal, Japanese records do not note their individual victories.

A sailor uses a stencil to apply a rising sun "victory flag" beneath the cockpit of SBD-3 BuNo 03315 from VS-71 embarked in *Wasp* following combat off Guadalcanal in on August 25, 1942. The unit was credited with five kills in total, with the first of these being a "type Zero landplane VF" claimed by Lt(jg) Robert L. Howard over Tulagi on August 8. (NHHC)

AFTERMATH

The SBD has to be the most successful dive-bomber of World War II. In 1942 alone it sank in whole or in part six aircraft carriers, one battleship, three cruisers, four destroyers, one submarine, and 14 transports (the latter mainly off Guadalcanal), although a few were shared with shore-based USAAF aircraft. Its moment of glory, however, was brief, and indeed the whole dive-bombing concept came to an end with the evolution of the fighter-bomber and the introduction of air-launched guided ordnance like the German *Fritz X* and Henschel Hs 293 anti-ship bombs.

The Dauntless rapidly disappeared from the fleet from early 1944 with the arrival of the larger, and less loved, SB2C Helldiver. The SBD's liabilities were beginning to catch up with it, as the aircraft's non-folding wings and moderate range did not fit into the operational doctrine of the new Fast Carrier Task Force, centered on the Essex-class carriers. Ironically, had the SB2C replaced the SBD in 1941, like the US Navy had originally planned, the battle for control of Guadalcanal may have been lost. The primitive conditions at Henderson Field showed the SBD to be reliable, rugged, and easily maintained. In contrast, the SB2C's complex hydraulic system made it a high maintenance aircraft. A shortage of parts, tools, and trained personnel would only have exacerbated these problems, making it highly unlikely that the Helldiver could have generated the sortie rate achieved by the SBD.

In the Central Pacific, a mix of US Marine Corps and US Navy SBD units continued to pummel bypassed enemy islands until late 1944. They were joined by No. 25 Sqn from the Royal New Zealand Air Force flying SBDs from Bougainville. US Marine Corps SBDs from MAGs 24 and 32 provided close air support during the Philippine campaign from January 1945, dropping their last bombs in July.

The introduction of both the F6F Hellcat and F4U Corsair proved a quantum leap in fighter-bomber capability. Rugged, fast, and well-armed, they overwhelmed the Japanese fighter force from late 1943. Capable of carrying 2,000lb of bombs or ten air-to-ground rockets, they could fill the many and varied roles of fleet defense, escort, ground support, and anti-shipping operations. This resulted in the US Navy's decision to downsize the complement of specialized attack aircraft embarked in its carriers. In 1943, Essex-class vessels carried a 80-aircraft Carrier Air Group comprising 36 F6F fighters, 26 SBDs or SB2C dive-bombers, and 18 TBF/TBM torpedo-bombers. The SBDs flown by VS squadron were eliminated in November 1943, replaced by radar-equipped Avengers. In November, the Carrier Air Group composition changed again, with its 96 aircraft consisting of 54 Hellcats, 24 Helldivers, and 18 Avengers.

Essex underway in the Pacific during May 1943, shortly after the brand new carrier had joined TF 16 at Pearl Harbor. The vessel had Carrier Air Group 9 embarked, which included VB-9 with 32 SBD-4s. By 1943, the Douglas dive-bomber's liabilities had begun to catch up with it. The 24 Dauntlesses seen here parked aft behind TBF-1s and F6F-3s clearly show how much valuable deck space they took up due to their lack of folding wings. This also made the SBD less suitable for use from the increasing number of light and escort carriers – which had appreciably smaller flightdecks than the Essex-class vessels – then entering service with the US Navy. (US Naval Historic Center)

As the SBD passed from carrier service, the IJNAF was forced to soldier on with the now obsolescent A6M5. From 1941 until the service introduction of the F6F in September 1943, the Zero-sen was the world's best carrier fighter. Yet despite its then-unrivaled capabilities, which were fully exploited by well-trained pilots, A6M-equipped units embarked in IJN carriers and shore-based at Rabaul were unable to stop US Navy and US Marine Corps SBDs from delivering lethal blows at critical moments during 1942. With the Imperial General Headquarters' plans for a short war in the Pacific thwarted after the disaster at Guadalcanal, the Zero-sen was forced to soldier on as the IJNAF's primary fighter until Japan was defeated in August 1945.

The A6M was supposed to be replaced by the Jiro Horikoshi-designed Mitsubishi A7M1 Reppu, the IJNAF requesting that the new fighter be capable of attaining a top speed of no less than 397mph at 19,685ft, and have the ability to reach that altitude in less than six minutes. The first prototype flew on May 6, 1944, but it was considered to be underpowered – indeed, the A7M1 had a top speed of only 345mph, just 14mph faster than the A6M2. Serious delays in design and development meant the Reppu never entered production.

Two other land-based fighters that could have redressed the balance were the Mitsubishi J2M Raiden and Kawanishi N1K2-J Shiden-Kai. Both had good performance and armament, although the former was also plagued by technical problems. Again, too few were completed due to Japan's modest industrial capacity. In the end, Mitsubishi and Nakajima built 10,499 Zero-sens between them. SBD production totaled 3,923 aircraft.

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SBD Dauntless cover artwork
In one of the most successful scouting attacks of the war, Lt Stockton B. Strong and ARM1c Clarence H. Garlow of VS-10, embarked in USS *Enterprise* (CV-6), targeted the light carrier *Zuiho* on October 26, 1942 during the Battle of the Santa Cruz Islands. Either Strong (flying SBD-3 BuNo 06492) or his wingman, Ens Charles B. Irvine, with ARM3c Elgie P. Williams, hit the vessel aft with a 500lb bomb, rendering its flightdeck unusable. As the SBD-3s egressed at wavetop height, they were met by a heavy barrage of antiaircraft fire and attacked by three Zero-sens. As the Japanese fighters from *Zuikaku* curved in to attack, Strong and Irvine kept low and began weaving back and forth for mutual support while Garlow and Williams returned fire. One Zero-sen fired a burst well out of range, only to turn sharply for another pass. It duly presented Garlow with a perfect target, and a burst of fire from his twin Browning AN/M2 0.30-cal. machine guns ripped into the underside of the fighter flown by SEA1c Koichi Nakagami, who crashed into the sea. Garlow and Williams each claimed a Zero-sen shot down, but only one aircraft was lost. After being pursued for 45 miles, both SBD pilots finally found ample cloud cover to mask their escape. By then the tail section of Irvine's Dauntless had been heavily damaged and his starboard main fuel tank holed. After a 90-minute return flight, both crews landed safely on board *Enterprise*, their tanks almost dry.

A6M Zero-sen cover artwork
The first encounter between the Zero-sen and the Dauntless took place on the morning of December 7, 1941 when fighters from *Soryu*, escorting both torpedo- and dive-bombers targeting the Pacific Fleet base at Pearl Harbor, intercepted 18 SBDs from VS-6 (13 aircraft) and VB-6 (five aircraft). The latter had taken off from *Enterprise* to conduct a sector search southwest of the Hawaiian islands, before recovering at Ford Island. As the US Navy dive-bombers ended their patrols and headed for Hawaii, they ran into 180+ Japanese aircraft from the first wave attack on Oahu. Six SBDs would be shot down in short order, five of them by SEA1c Isao Doigawa and PO3c Shin-ichi Suzuki from *Soryu*. In this specially commissioned artwork, SBD-2 BuNo 04570 of Lt Clarence E. Dickinson and RM1c William C. Miller attempts to escape the fire of a pursuing A6M2. Dickinson, and the SBD flown by Ens John R. McCarthy and RM3c Mitchell Cohn, had been jumped at an altitude of 4,000ft as they headed for Barbers Point. As McCarthy maneuvered his SBD to support Dickinson, he was hit, falling away in smoke and flames. McCarthy managed to bail out, but his gunner was killed. Four more Zero-sens then arrived, and Dickinson began evasive maneuvers to throw off the attackers' aim. Miller also returned fire, only to be wounded early in the combat. In the end Dickinson could not evade them all, and cannon shells ripped into his starboard wing and set it on fire. As his SBD entered into a right-hand spin, Dickinson bailed out at just 800ft. Miller did not survive.

TITLE PAGE
Having seen no action while flying CAP from *Zuikaku* during the Pearl Harbor attack, FP01c Tetsuzo Iwamoto (who was already a 14-victory China ace) made up for this by claiming several SBDs and F4Fs destroyed during the Coral Sea clash on May 8, 1942. He was eventually credited with an estimated 80 victories, his diary recording 202 attacks against enemy aircraft utilizing single pass hit and run dives from higher altitude. (Tony Holmes Collection)